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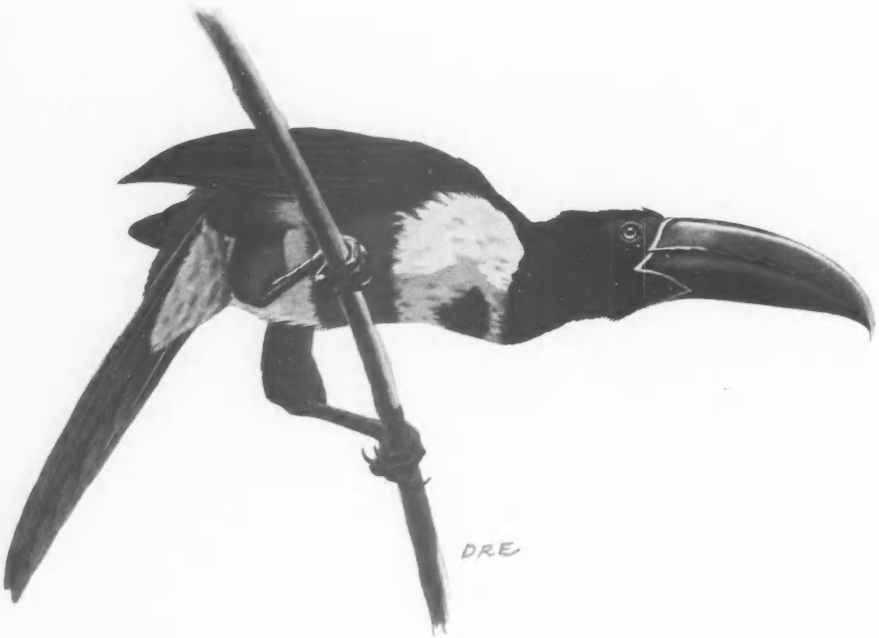

FIERY-BILLED ARAÇARI

PTEROGLOSSUS FRANTZII

Adult male, one-third natural size

From a water color by Don R. Eckelberry

THE CONDOR

VOLUME 60 JULY-AUGUST, 1958 NUMBER 4

ROOSTING AND NESTING OF ARAÇARI TOUCANS

By ALEXANDER F. SKUTCH

The genus *Pteroglossus* contains a number of species of toucans of small or medium size to which the name araçari is usually given. The slenderness of body and bill in the Central American representatives of this group is very evident when one compares them with the bulky toucans of the genus *Ramphastos* which inhabit the same forests. Of the two species of *Pteroglossus* in the lowlands and foothills of Central America, *P. torquatus* is of wide distribution, while *P. frantzii*, far brighter in color, is restricted to the Pacific side of southern Costa Rica and adjoining parts of the republic of Panamá. Although these two birds were united in the same species by Peters (1948), their differences in coloration are evident at a glance and they do not seem to intergrade. Yet their similarities in voice, habits, size, and color pattern show that they are closely related. Since my studies of these rather elusive birds are incomplete and since there is little information available on their behavior, I shall discuss them in the same paper. Thus gaps in my observations on one species may be filled in a measure by my studies of the other species.

COLLARED ARAÇARI

Appearance.—The Collared Araçari (*Pteroglossus torquatus*), the duller and more widespread of these two toucans, is a slender bird, whose length of about 16 inches is largely accounted for by its heavy bill and long, graduated tail (fig. 1). The general tone of the head and most of the upper plumage, including the wings and tail, is black. A narrow collar of chestnut separates the glossy black of the hindneck from the greenish slate-black of the back, while the rump and upper tail coverts are bright red. The plumage below, posterior to the foreneck, is generally yellow, interrupted by a band of black and red which crosses the upper abdomen from side to side. Anterior to this the yellow is more or less stained with red on the breast, which often bears in its center a black patch of variable size. The thighs are chestnut or cinnamon-rufous. The bill is long, high, hooked at the end, and has coarse serrations along most of the cutting edge of the upper mandible. As in many toucans, this relatively enormous bill is particolored in a rather intricate pattern. Most of the upper mandible is pale grayish-yellow or dull white, becoming darker toward the base, with dusky blotches between the tooth-like projections, and a broad black stripe along the basal half of the ridge. The lower mandible is black, and the whole bill is outlined at the base, where it joins the feathered portion of the head, by a narrow, embossed ridge of ivory-white. To add to the array of color on this bird's head, its eyes are bright yellow or orange-yellow, surrounded by bright red bare skin. The legs and feet are greenish-olive. The sexes cannot be distinguished by their appearance.

Range and general habits.—The Collared Araçari ranges from southern México to Colombia and Venezuela. In Central America it is found along the length of both coasts, except in the restricted region where the Fiery-billed Araçari (*P. frantzii*) is established. In both Guatemala and Costa Rica, it ranges upward to about 3000 feet—far less than many of its associates in the warm lowlands. It inhabits rain forest, semi-arid woodland, and adjoining clearings with scattered trees or shady plantations. Its flight is swift and

Fig. 1. Collared Araçari (*Pteroglossus torquatus*), one-third natural size. Drawing by Don R. Eckelberry.

direct. A gregarious bird, it roams through the tree-tops in restless parties containing up to six, or rarely more, individuals, which straggle after each other rather than travel in a compact flock as do many parrots and pigeons. In the rain forests where the larger Keel-billed Toucan (*Ramphastos sulphuratus*) occurs, the araçari sometimes associates with it.

This araçari subsists largely on small fruits, which it plucks with the tip of its great bill and transfers to its throat by means of an upward jerk of the head. It also gathers insects and other small invertebrates, especially when feeding nestlings. Although, like its close relative the Fiery-billed Araçari, it probably includes birds' eggs and nestlings in its diet, I have no incriminating evidence of this. A further discussion of the feeding habits of this bird is to be found in the section on nesting.

Voice.—The notes of the Collared Araçari are, for so large a bird, remarkably thin and high-pitched and add to the impression of high-strung excitability which this toucan gives. Its common call is a *pink* or *penk*. Some members of a flock which I saw in August in the coastal mountains of northern Honduras were singing after a fashion. Their high-pitched, rather barking *peetch* was rapidly repeated in ascending pitch, becoming weaker and shriller with each reiteration. As they uttered this note they swung their heads from side to side. When suspicious or alarmed, the araçari gives a thin, sharp *pitit*, and when it is highly excited it repeats this note with great rapidity.

Roosting.—Although I had tried previously to trace to their sleeping places flocks of araçaris that I encountered in the evening, I was not successful until I went to Barro Colorado Island in 1935. For many years after a portion of the valley of the Río Chagres was flooded to form Gatún Lake, a part of the Panamá Canal, the drowned forest trees, which stood like bleached skeletons above the shallow water, provided convenient quarters for a variety of birds that nest and roost in holes. Aside from cavities caused by decay, most of the holes had been made by various species of woodpeckers. These holes were taken over by other species of birds after the woodpeckers either had abandoned them or had been forcibly evicted.

At 6:40 p.m. on February 14, as I paddled my cayuco into the cove in front of the main building on Barro Colorado, I had the good fortune to see four Collared Araçaris enter a large hole in the top of a naked dead trunk which stood in the water just beyond the end of the wooded point of land at the entrance to the inlet. The hole had apparently been made by a woodpecker but it was now enlarged by decay. On the following evenings, the four araçaris retired at times ranging from 6:38 to 6:43 p.m. They always approached from the forest at the top of the banana plantation which occupied the steeply sloping ground on the opposite shore of the cove. One by one, the birds would fly rapidly down over the bananas, cross the cove, and enter the forest on the other side. Then they made their way through the trees to the end of the point, where the woodland came nearest to their exposed sleeping tree. In the morning, they emerged and flew back into the forest at about 6:15 a.m., so that at this season they took slightly more than 11½ hours of rest. At various times I saw them enter or leave this trunk through three different openings, but possibly all of these openings communicated with a single large hollow.

At some time between February 19 and 25, the araçaris deserted this dormitory. On the evening of March 17, I again saw the toucans enter it, but their number was now reduced to two. At 6:00 a.m. on March 29, four araçaris left the hollow stub. My next record for this dormitory is for May 29, when two araçaris flew out at 5:40 a.m. The fluctuations in the tenancy of this hole appear, at least in part, to be due to the fact that araçaris, like other birds which sleep in dormitories, often have several such dormitories scattered over their territory, and if disturbed at one they take shelter in another. Moreover, these observations were made just before and in the course of the breeding season, and, as we shall see, the number of individuals sleeping in the nest varied with the progress of the brood. This doubtless contributed to the fluctuations in the number of lodgers in this dormitory. It is not unlikely that the same individuals occupied, at different times, both this hole and a higher one that was used for rearing a brood.

Nine years earlier, Van Tyne (1929:20) discovered in this same locality four Collared Araçaris roosting in an old woodpecker hole which was about six feet below the top of a dead trunk that was 20 feet high. This trunk stood at the edge of the clearing beside the main building rather than in the water in front of it. As the birds "entered the hole they could be seen to jerk their long tails . . . flat against their backs, thus saving much valuable space."

On the evening of February 22, after watching an Olivaceous Flatbill (*Rhynchocyclus olivaceus*) dart into its pensile nest, I wandered through the darkening forest on Barro Colorado to look for other roosting birds. A sharp *penk* drew my attention to some Collared Araçaris in the trees high above me, and by rare good fortune I managed to follow them to their lodging, which was situated about a hundred feet above the ground, far out in a thick, horizontal limb of an immense tree. The entrance, on the lower side of the bough and facing straight downward, was barely wide enough for

the toucans to squeeze through it. I watched their dark, colorless figures, silhouetted against the sky, flutter below their narrow doorway and frequently turn back, to try again and perhaps a third time before they at last succeeded in gaining a foothold at the entrance. Having accomplished this difficult feat, they wriggled painfully in, the long tail of each projecting stiffly outward after the body had disappeared, then slowly following it. I counted six araçaris as they emerged at the night's end.

Apparently I had found the dormitory of these araçaris soon after they began to use it, for the difficulty they had in entering came largely from lack of practice. Between 6:45 and 6:48 p.m. on February 28, all six went in without fluttering below the doorway or returning to a perch for a fresh start after a fruitless attempt. That the aperture had not been appreciably widened in the interval was obvious from the slowness with which the birds squeezed through it, their long, projecting tails vibrating from their muscular exertions. Difficult as it was to reach this downward-facing orifice, with practice the araçaris became adept at entering it.

Nesting.—This high, inaccessible dormitory was soon afterward used for breeding, a conversion which caused all but one of the six occupants to find other sleeping quarters. Unfortunately, I could not reach the hundred-foot-high hole to learn just when the eggs were laid; hence I cannot demonstrate an exact correspondence between laying and the withdrawal of the majority of the lodgers, but my observations showed that this was a gradual and irregular process. By March 15, the number of occupants had been reduced to five; these entered the hole between 6:44 and 6:48 p.m. As it grew light on March 25, I saw one araçari looking out of the high doorway and another resting on a neighboring branch. After the former emerged, somewhat later than usual, a second araçari stuck its head through the orifice and remained in this position for a time, although in the past all the sleepers had emerged within a few minutes after the departure of the earliest. Either the araçari that I first noticed perching outside had left the dormitory while the light was still so dim that I had failed to notice its departure or it had slept somewhere near by. On the evening of March 27, I arrived just in time to see a bird leave the hole. Then another bird looked out and emerged after a few minutes, which was unusual at this late hour. After this, one araçari went in and promptly came out. Finally, at 6:47 p.m., a single araçari entered and stayed for the night.

By March 28, incubation had definitely begun, and whenever I stood in sight of the nest and clapped my hands loudly, a big pied bill was thrust forth from the narrow aperture. Despite the great height of the nest, and the fact that I stood as far as 100 feet from the base of the tree, the araçari in charge of the eggs felt so insecure that on seeing me it promptly squeezed through the doorway and flew off through the forest. For some nights following this, only a single bird slept with the eggs, but whether this was the female, or the male as in woodpeckers and some other families, I could not learn.

I made no detailed observations on incubation, which took place at the end of March and in early April. By April 11, five araçaris were again sleeping in this hole, and on the same day that I discovered this I, for the first time, saw one of them enter the hole with food. This was an indication that one or more nestlings had hatched. I soon became convinced that four of these five adult birds were bringing food, and I repeatedly had evidence of this. However, it was a long time before I could prove that all five did so. The best time for counting the attendants was in the early morning, when, after leaving the dormitory together, a number would return with food at about the same time. On May 16, when the nestlings were at least 35 days old, the adult birds began to return soon after emerging at 5:45 a.m. Five entered the nest in such

rapid succession that the last had delivered its food before the first flew out of sight, and I was quite certain that I had not counted the same individual twice. It was more difficult to learn how many of these attendants brooded, for while the nestlings were still very young a new arrival would usually enter the hole before the emergence of the one already present, and this made it impossible to tell whether there had been a change-over. However, it seemed that at least two birds brooded. By April 24, thirteen days after I noticed that the nestlings had hatched, they were brooded little during the day.

The nature of the nestlings' food, and the method of carrying and delivering it, changed as the young grew older. At all times the attendants were most wary in approaching the hole, and they would usually perch on a high bough of a neighboring tree, turning their heads and great bills from side to side while they scrutinized the surroundings, before they proceeded to the doorway. This pause often permitted me to see what they carried. During the first few days I noticed only insects, which were grasped in the tip of the bill, the wings sometimes projecting from the sides. When the young were a month old, they still received many winged insects, but small fruits were becoming a more prominent component of their diet. Although I saw a large cicada taken into the nest in the tip of an attendant's bill, when the young were about ready to fly, toward the end of the nestling period most of the food was carried in the mouth or throat and I rarely had an opportunity to see it. Apparently this change in the manner of transporting the nestlings' food was an adjustment to the larger quantities that were now required. Until the young were over a month old, the attendants laboriously wriggled into the hole each time they brought food, but by May 16, at least 35 days after the nestlings had hatched, I noticed that the young ones took some of their food through the doorway while the attendant clung below it. Thenceforth an increasing proportion of their food was passed to them in this fashion.

Although this new method of feeding spared the attendants the trouble of squeezing through the narrow orifice, to the detriment of their plumage, it brought new difficulties to them. They now delivered the food while clinging back downward, and in this inverted position they could not regurgitate what they carried in the deeper portions of their alimentary tract. The last article which an attendant had found for the nestlings was often held prominently in the tip of its bill when it arrived, and to deliver this caused no special difficulty. This was true also of the morsels carried in the mouth or throat. But after passing to the nestlings the more available pieces, the attendant was often obliged to fly to a neighboring perch, where, standing upright, it could regurgitate certain objects that had been swallowed. This was a feat which was accomplished with considerable effort, to judge by the contortions of the bird's neck which were clearly visible through my binoculars at a distance of fifty yards. The newly recovered food was then carried to the nest for transfer to a nestling. The rate of feeding was very rapid, especially in the early morning. However, since I was ignorant of the number of mouths which were receiving these contributions, there seemed to be no point in counting the feedings when there were so many other interesting details to be observed.

Toward the end of the nestling period, one of the principal articles brought to the young was the "wild nutmeg," the seed of a tall forest tree of the genus *Virola*. The elongate, grayish-brown seed was brought to the nest still encased in the bright red, coral-like, branching aril, which resembles the mace of the true nutmeg and is the only digestible portion. The seeds themselves were later regurgitated entire. The brown seed with its red aril formed a most attractive object; it measured about three-quarters of an inch in length by slightly over half an inch in width. When ripe, the aril was pleasantly spicy to my taste, but when not quite mature it was so hot and peppery

that I could scarcely endure it. Even at this stage, however, it seemed to attract Massena Trogons (*Trogon massena*) as well as toucans, which flocked in the early morning to a fruiting nutmeg tree at the forest's edge, where they swallowed these large objects whole.

After the young were a month old, the attendants carried large billfuls of waste material from the nest. Apparently they were keeping the chamber clean. Probably I had not noticed the removal of waste earlier because of the smaller amounts that were carried away.

One day while I watched the araçaris' nest, two Chestnut-mandibled Toucans (*Ramphastos swainsonii*) flew into the nest tree. One of them soon discovered the location of the hole, probably by hearing the nestlings within. This bird appeared to be interested and flew from branch to branch around the hole, but it was not as easy for this big toucan to reach the downward-facing doorway as it was for the smaller and more agile araçaris. Presently it hovered beneath the hole and stuck the tip of its great beak into the opening. After an interval, it repeated the performance and pushed its bill farther into the hole. I doubted that it could reach the nestlings, for the entrance was far too narrow to admit its big body and the cavity which provided space for six or more araçaris was obviously deep. But I did not consider the visitor's intentions to be benevolent, and I did not want to lose this interesting nest, so I emerged from the blind and drove the bird away. The araçaris were not in sight while their larger relative was present. Since the Chestnut-mandibled Toucan is a persistent nest-robber, the araçaris had done well to choose a hole with a doorway too narrow to admit this larger bird.

The fledglings' departure and attempted return to the nest.—The attendance of a single nest by five araçaris raised some interesting questions. Did these birds nest communally like the anis (*Crotophaga*)? Or did they require two or more years to reach breeding maturity and did yearlings help older birds to attend their young, as do White-tipped Brown Jays (*Psilorhinus mexicanus*)? Or was there an excess of males which assisted mated pairs to rear their offspring, as in Black-eared Bush-tits (*Psaltriparus melanotis*)?

These questions were difficult to answer because the five attendants all appeared very much alike, with no differences indicative of age or sex. But had I known the number of young in the nest, this would have helped to solve the problem. Since toucans generally lay only two or three eggs in a set, if there were considerably more young than this, one might assume that several females had laid eggs in the same nest. Because the nest was inaccessible, the only possibility of learning the number of nestlings was to count them as they emerged or, better, as they returned to sleep in the cavity. I had found in a number of species that when the adults use the nest space as a dormitory they often lead the fledglings back to roost in it, and I expected that the araçaris would do this, too. Accordingly, I watched carefully for the youngsters' departure.

Thirty-five days after I first saw an adult bring food to this nest, the attendants were passing some of the food to the young through the doorway, indicating that the nestlings had moved up close to the opening. Two days later I saw, for the first time, a nestling push its head outside to take its food. The young bird's bill already looked almost as big as that of the adults. When the nestlings were at least 42 days old, one of them spent much time looking through the doorway, and I now first heard their voices. They called *pitit* like the adults, but their call was weaker. The attendants had now become extremely excitable, calling frequently and appearing to be uneasy.

On May 24, the five attendants left the hole at dawn, as they had done since the nestlings had hatched, and soon they returned with food for the young ones in the nest.

Other birds occupied my attention through the day, but after supper I returned to watch the araçaris retire. One of the young had emerged since sunrise and the attendants were helping it to return to the hole for the night. While one of the adults hung, back downward, beneath the doorway, the fledgling came and clung momentarily to its back. Meanwhile the other adult birds clustered around, crying *pitit pitit* in their high-pitched voices and displaying considerable excitement.

The leaves were fast falling from the nest tree and the araçaris were exposed to the open sky. Suddenly a White Hawk (*Leucopternis albicollis*) swooped down and seized the fledgling in its talons. The victim cried piteously as its captor bore it across a deep ravine, followed by all the attendants. Later, when the light had become very dim, the five adult araçaris returned to the nest tree and darted into the hole as rapidly as the narrow orifice would allow. On the next morning, May 25, after a cautious departure from the nest, and in a highly nervous state, they continued to bring food to the remaining nestlings. They often dashed off with shrill cries at times when I saw no cause for alarm, although they might have seen the hawk soaring over the forest or resting in a tree-top beyond my view. That evening, when the bird of prey appeared again, only two adults entered the hole in the waning light. On the following morning, May 26, a friend who helped me guard the nest saw another fledgling emerge from it. The young one, almost as large as the mature birds but with a noticeably shorter tail, was soon led off through the tree-tops. At nightfall only two adults went to rest in the hole, where at least one nestling remained. On May 27, I was unavoidably absent, but at dawn on May 28 I saw a single adult leave the cavity, where it had slept alone, for the last of the brood had apparently departed on the preceding day. But for the unfortunate intrusion of the White Hawk, whose relations with the araçaris are reported in some detail in an earlier paper (Skutch, 1950), I have little doubt, from the observed behavior of the young bird which had emerged first, that the whole family, adults and young, would have continued to roost in the high hole.

Apparently there had been three nestlings. I first saw an attendant take food into this nest on April 11. At least one young araçari left on May 24, and the last young bird left on May 27. From this we may deduce that the fledgling which departed first was no less than 43 days old. If the young hatched on successive days, the last one to emerge must have been about the same age as the others at this stage. Since the attendants might have been bringing food for a day or two before I saw them do so, the nestling period of the Collared Araçari may be placed conservatively at 44 days. I found the nestling period of the Blue-throated Toucanet (*Aulacorhynchus caeruleogularis*) of the Costa Rican highlands to be at least 43 days (Skutch, 1944:145), while from incomplete data Van Tyne (1929:34) calculated the nestling period of the Keel-billed Toucan at 45 days. This last is probably too short an estimate for the nestling period of this much larger bird.

On the evening of June 1, four adult araçaris retired to rest in the high hole where the family had been reared. The following day I left Barro Colorado, and I never learned where the young lodged.

Van Tyne (1935:25) records a nest of the smaller race *P. t. erythrozonus*, which was discovered at Uaxactun, El Petén, Guatemala. This nest was about 45 feet above the ground in a thick, upright limb of a tree at the edge of a clearing, and on May 20 it contained three plain white eggs on the point of hatching.

FIERY-BILLED ARAÇARI

Appearance.—In size and plumage, the Fiery-billed Araçari (*Pteroglossus frantzii*) resembles the Collared Araçari, but there are certain conspicuous differences. The trans-

verse band across the middle of the ventral surface is much broader and is completely red with the exception of a narrow black margin on the anterior side, or a line of black spots in this position. There is the same dark chestnut collar across the hindneck, the same chestnut or deep cinnamon-rufous on the thighs, and the same black patch in the center of the yellow, red-tinged breast. But the bill, which in all toucans is so conspicuous a feature, is strikingly different in the two forms. That of the Fiery-billed Araçari is orange-red over the greater portion of the upper mandible. Toward the base, this color fades to yellow or greenish-yellow, and there is a black band along the basal half or more of the culmen. The lower mandible is largely black, and both parts of the bill are outlined at the base by a narrow whitish line which contrasts with the black head. The eye is bright yellow, with a triangular area of bare, red skin behind it. The feet and legs are olive-green.

Range and general habits.—This brilliant toucan is confined to the Pacific side of Costa Rica, from the Gulf of Nicoya southward, and to the adjoining regions of western Panamá. In Costa Rica, it breeds from sea level up to no less than 3000 feet and it ranges at least a few hundred feet higher. In the Volcán Chiriquí region of Panamá, it has likewise been recorded at 3000 feet above sea level (Ridgway, 1914:347). It lives chiefly in the upper levels of the tall rain forest of this wetter part of the Pacific littoral of Middle America, but it often forages and nests in neighboring clearings where there are scattered living or dead trees. Its flight is swift and direct, and it travels in loose, straggling bands which at times contain as many as ten individuals but are usually smaller.

Sometimes a number of these toucans fly back and forth among the boughs in what appears to be a playful mood, and then they occasionally strike their heavy bills resoundingly against a trunk or branch, apparently merely to hear the report. One morning in April, I watched what seemed to be a more elaborate form of play, which took place on a lofty horizontal branch of a tall tree a short distance within the edge of the forest. Two araçaris, facing each other, struck their long red bills together, somewhat as fencers do with their swords when on guard. Then they grasped each other's mandibles and pushed, until at length one of the contestants was forced backward and hung below the limb, after which it admitted its defeat by flight. The victor held its ground, and soon a third member of the flock approached to challenge it. Again the opponents struck their bills together, then grasped and pushed. This time the winner in the first bout was itself forced from the bough and flew away, leaving the newcomer there as undisputed champion. These contests appeared to be carried on without anger, and the loser was never pursued.

While travelling through the great forest which twenty years ago covered most of the middle reach of the Térraba Valley, I watched a flock of araçaris bathe, one after another, in a pool of rain water which filled a small cavity in the upper side of a thick, horizontal branch above the trail. Similarly, I once watched a pair of Chestnut-mandibled Toucans bathe in the rain water that filled a crotch high up in a tree, but I have never seen toucans of any kind wet their plumage in a stream or pool at ground level.

Food.—Fiery-billed Araçaris eat the fruits of forest trees and sometimes descend into the low, rank growth of new clearings where, in company with a variety of tanagers, honeycreepers, manakins, and other birds far smaller than themselves, they feast upon the juicy purple-black berries of the jaboncillo or pokeweed (*Phytolacca rivinoides*) that grows so profusely on burnt ground. Seizing a little berry in the hooked tip of its great bill, the araçari tosses it into its throat by means of an upward jerk of its head. The eggs and nestlings of other birds vary the largely frugivorous diet of this toucan. I once

surprised one removing a white egg from the hole of a pair of Golden-naped Woodpeckers (*Tripsurus chrysauchen*) while the parents vainly protested, and at another time I saw a parent araçari bring a newly hatched nestling of some passerine bird to its own young. In the breeding season, the araçaris periodically visit our dooryard, which adjoins the forest, to search through the shade trees and shrubbery. Although I cannot recall having actually seen them pillage a nest, the distress of the birds breeding in the area, and the fact that nests are often prematurely empty after the toucans have left, are strong circumstantial evidence that they come to plunder. Hence, before they have an opportunity to carry out their designs, they are usually sent on their way.

Whatever other uses the toucans' huge bills may have, one need only watch these birds on a pillaging excursion to become convinced that the size and color of the bills serve to intimidate the smaller birds which the toucans persecute. As far as I have seen, the boldest of them will not dare to touch a perching araçari or other toucan and risk a nip from the terrifying beak. But some of the larger and more spirited flycatchers will buffet flying toucans when the latter seem unable to turn their heads and defend their backs.

Early in March I watched two araçaris eating the fruiting spikes of the guarumo tree (*Cecropia* sp.). Sometimes one would break off a small piece and, after a little pressing between the tips of the mandibles, throw it back into its throat with an upward toss of the head and swallow it. Sometimes, detaching a longer piece of the cylindrical green spike, the bird would hold it against the perch with one foot and tear off small pieces to swallow. Finally, one of the pair, probably the male, approached the other and gave it a piece of the food. Then both flew off to the forest.

I was reminded of this incident when, years later, also in early March, I saw a Fiery-billed Araçari with a strangely deformed bill. The brilliant upper mandible of this bird was strongly bent both upward and sideways, so that there was a prominent gap between the two mandibles in the terminal half of the bill; moreover, the tip of the upper mandible was not above that of the lower but well to the side of it. I believe that such a deformity could have arisen only in the embryonic, or at least in the nestling stage of this bird's development, and I doubt very much whether it could have fed itself well enough to stay alive. Certainly it would have been greatly handicapped in eating; yet it was full grown, in fine plumage, and apparently otherwise in good condition. I surmised that its companions, or possibly only its mate, supplied it with much of its nourishment; unfortunately the flock did not remain in view long enough for me to witness this.

Voice.—The call of the Fiery-billed Araçari is a high, sharp *pink, pitit,* or *pity,* in tone very much like the note of the Collared Araçari. I am not certain that I could distinguish the two species by their voices.

Roosting.—Most of my observations on the sleeping habits of the Fiery-billed Araçari were made in my early years in the valley of El General in southern Costa Rica, from 1936 to 1943. In this period, new settlers were pouring into this originally forested region and making great inroads on the woodland. Usually, when clearing an area of forest, they would spare a few scattered trees to avoid the labor of felling them or to serve as future sources of firewood. These isolated trees were invariably killed by the fire set to clear the land for planting, and often the flames would attack additional trees at the margin of the intact forest. Soon decaying, these dead or dying trees were drilled by woodpeckers, especially the Golden-naped Woodpecker, the Red-crowned Woodpecker (*Centurus rubricapillus*), the Lineated Woodpecker (*Dryocopus lineatus*), and the Pale-billed Woodpecker (*Phloeoceastes guatemalensis*), to make holes for roost-

ing and nesting. When the woodpeckers had finished with these cavities, or sometimes before, they were claimed for nesting and sleeping by the araçaris, Streaked-headed Woodhewers (*Lepidocolaptes souleyetii*), Masked Tityras (*Tityra semifasciata*), Black-crowned Tityras (*T. inquisitor*), Gray-breasted Martins (*Progne chalybea*), and sometimes Southern House Wrens (*Troglodytes musculus*). When, in 1941, I bought my farm in El General, there was a large new clearing that still smoked, with its usual quota of standing charred trees. Since then, no more forest has been felled on this farm. After the fire-killed forest trees toppled over, observations on the roosting and nesting of the araçaris came to an end, for I have not found them sleeping or breeding in the midst of intact forest, as doubtless they originally did and still often do.

Only the largest of the woodpeckers which nest in these clearings, the Pale-billed and the Lineated, carve holes large enough to accommodate the araçaris. The Lineated Woodpecker is more abundant and accordingly it is the chief provider of lodgings and nest chambers for the toucans. As they wander through the log-cluttered recent clearings with scattered standing trees, the araçaris, ever on the lookout for good dormitories, examine the available cavities, often poking their heads into the holes before the makers have abandoned them. This causes much distress among the smaller of the hole-nesters. The progress of a band of araçaris through such a clearing at the height of the nesting season is attended by the angry, darting flights and complaining cries of the numerous birds which breed there.

Apparently it is chiefly as a safeguard against these great-billed intruders that the larger woodpeckers spend so much time with nestlings that are already feathered and no longer require brooding. At a nest of the Lineated Woodpecker that I watched for nine hours on April 3, 1940, the male spent four and a half hours guarding two young which were almost as large as he and nearly ready to fly. Twice during my vigil, parties of araçaris came to the nest and were repelled by the parent woodpeckers, once by the male from the inside and once by the female from the outside. Whenever a large bird flew up to the charred trunk, the male drew down into the cavity where he could not be seen from the front. Apparently not noticing that the hole was guarded, an araçari thrust its head inside and received on its beak an audible tap from the sharp bill of the woodpecker. This happened twice, on different days.

Since the Lineated Woodpecker does not, like some other members of the family, use its nest cavity as a dormitory after the departure of the young, these holes become available to the araçaris as soon as the brood has flown. The nesting hole just mentioned remained untenanted at most two nights after the fledglings had left, for on the third night I discovered araçaris sleeping in it. In 1936, a nest of the Lineated Woodpecker that I had been watching was also taken over by araçaris a few days after the brood had flown. In each of these holes, five araçaris sometimes lodged. In 1942, in another locality, I again found five araçaris roosting in a woodpecker hole which had been made apparently by this species. The capacity of the Lineated Woodpecker's nest cavity seems to be limited to five full-grown araçaris, for one evening when five araçaris entered a woodpecker hole that I watched in 1940, three more went to rest in an older cavity not far away.

I have never found more than five Fiery-billed Araçaris sleeping together, but I have often seen from one to four enter a hole. Their sleeping arrangements change within short periods of time. Apparently they usually know a number of available lodgings, discovered on their periodical tours of investigation, and if alarmed or ill at ease at one, they readily fly off to another as the day ends. Often there is much cautious inspection of the holes while clinging in front, much going in and out of the cavities, and much flying back and forth in the waning light, before all the members of a flock are com-

fortably installed for the night. Compared with woodpeckers, araçaris retire late in the evening and arise early in the morning.

The abandoned woodpecker holes are also in demand by other birds, especially by Gray-breasted Martins and Masked Tityras, for nesting, and this brings these birds into competition with the araçaris. In my life history of the Masked Tityra (1946:352–360), I related some of the difficulties which this timid bird has with her huge-billed, greatly feared neighbors. Even when they do not contend for the same hole, the araçaris often sleep or breed in another cavity in the same tree that holds a nest of the tityra. But sometimes the araçaris are the aggrieved party. In 1939, in a narrow clearing between two strips of forest, I watched a hole in the top of a tall dead tree into which a female tityra was carrying inflorescence stalks and dead leaves for her nest. When in the evening three araçaris arrived to sleep in this hole, where they may well have been lodging long before the tityra claimed it, she and her mate pursued them in flight and darted at them while they clung at the doorway, inspecting the interior before they entered. The toucans, however, paid slight attention to the tityras, which remained watching the hole until after the larger birds had retired; then they flew off in the dusk to sleep in the forest. This went on for a number of evenings, and, although I doubt that the tityras ever found courage to strike the toucans, some of their pursuits showed great spirit. By day, when the araçaris were absent, the female tityra continued to fill the cavity with coarse material, and one evening the lodgers arrived to find the space so reduced that they had difficulty in accommodating themselves. The first araçari went in without trouble but the second tried several times to enter and then flew to the edge of the forest. The first araçari came out, whereupon the second returned to the hole, stuck in its head, pulled out a bunch of material consisting largely of dry leaves, carried it to a neighboring tree, and dropped it. Finally, two birds entered the cavity to sleep and the third went elsewhere.

The following evening two araçaris entered the hole without difficulty. Then the tityras stood side by side on the top of the stub, peering over the edge to see what was happening below them. Presently, as it was growing dark, the male flew off leaving the female alone on the stub. While she stood there the third araçari arrived very late, and finding it troublesome to enter the reduced space head first, it turned around and inserted itself forcibly tail foremost, as woodpeckers sometimes enter their dormitories. As the araçari went in, I clearly saw it turn its long tail forward over its back; on subsequent evenings I repeatedly witnessed this procedure. In these circumstances, the value of this arrangement in saving space was obvious.

On the morning of April 26, the female tityra, after much hesitation, entered the hole and stayed for about 20 minutes, probably laying an egg. This was doubtless broken when three araçaris squeezed in above it that evening. The last araçari folded its tail over its back as it struggled rump first into the crowded quarters. A few days later, this hole was abandoned by both araçaris and tityras. If, as I suspect, one or more eggs were broken in it, ants might have arrived and made it untenable by the birds. By the middle of May, however, the tityras were nesting in this disputed cavity. Mild mannered as they are, tityras often gain their objective through their great persistence. Higher in this same tree a pair of Golden-naped Woodpeckers nested while the dispute was in progress, and one evening, before the araçaris arrived, eight small bats dropped one by one from a neighboring hole, where they had slept through the day.

Roosting arrangements of a mated pair throughout the year.—The parties of four to eight araçaris, which, even at the height of the nesting season in April and May, wander through the clearings and lodge either together or in neighboring holes, appear to be composed largely, if not wholly, of nonbreeding individuals. The presence of

these groups suggests that Fiery-billed Araçaris do not begin to nest until at least the second spring following that in which they were hatched. These observations on a related form make it appear probable that three of the five attendants at the Collared Araçaris' nest previously described were young, unmated helpers, probably yearlings, as has been noted in the Brown Jay (Skutch, 1935).

At the end of my first February in El General, a flock of between five and eight Fiery-billed Araçaris would come in the evening to an abandoned cornfield at the edge of the forest, on a slope high above the Río Buena Vista and 3000 feet above sea level. Here were a number of tall, fire-killed trees, standing above the bushes and vines that were fast growing up into an impenetrable tangle over the steep mountainside. In the trees were many woodpecker holes, some still unfinished, some with eggs or nestlings, some newly deserted by their makers, and others in various stages of decay. The araçaris examined many of these cavities, but they were chiefly interested in one that had been abandoned only a day or two earlier by a brood of Lineated Woodpeckers. On the evening of February 26, four araçaris entered this lofty hole, while one clung beside the doorway; then all swarmed out and flew off to the forest, and finally one returned to sleep alone in the cavity. The following evening, two slept in this hole, while a third retired into an older cavity close by in the same trunk. On the third night, the new hole was occupied by four araçaris, while the old one where a single bird had slept remained empty. On the fourth evening, no araçari came to lodge in this clearing. On the fifth evening, five packed themselves into the Lineated Woodpeckers' hole and stayed, to the great annoyance of a Masked Tityra which was beginning to nest in a neighboring cavity in the same trunk. On the sixth night, four araçaris slept in the woodpecker hole; on the seventh night, there were again five. This will serve as an example of the inconstant behavior of a flock of Fiery-billed Araçaris as their nesting season approaches.

By March 10, one member of the flock had begun to sleep in another hole which had a doorway so narrow that the bird could hardly squeeze through. It was about a hundred feet above the ground in a great dead tree which stood a short way down the slope from the one in which the others roosted. This woodpecker hole with a narrow orifice was selected as a nesting site. Now the flock rapidly dwindled away, until the old cornfield on the mountainside was left in the possession of two birds which soon showed clearly that they were a mated pair. The two slept apart, one in the hole in the tree lower on the slope, where incubation began at about the end of March; the other slept 50 feet away in the Lineated Woodpeckers' hole, which not long before had provided shelter for the five araçaris. Since among toucans the male and female are similar in appearance, I could not learn which was in charge of the eggs through the night and which slept in the neighboring lodge. By day, the two took turns on the eggs (see section on eggs and incubation). By the middle of April, the parents were carrying small insects into this high nest, but before the young were fledged the tree was cut down.

After the loss of their nest, the pair slept together in the Lineated Woodpeckers' hole. They now came out so unusually late in the morning that I concluded that they were feeling broody and would attempt a second nesting, but apparently they laid no more eggs that year. With the araçaris' usual wavering attachment to their dormitory, they slept in the woodpecker hole intermittently until the owner of the land cut the tree for firewood in August. Then for two months I lost track of them. But in October I found a pair, without much doubt the same, lodging in a hole recently carved by a woodpecker in the trunk of a *Cecropia* in the same clearing. This hole was only 20 feet above the ground, and it had a doorway so wide that in the morning, when they lingered in their dormitory, both birds could look out together, with the end of the great red bill of one beside or above the projecting head of the mate. Although they did not sleep

in this hole consistently, it was one of their principal lodgings until the following February. These two araçaris, once mated, seemed never to rejoin the flock from which they had separated in the preceding March. They kept apart, at least by night, and preserved their domain through all the months when they did not breed. Yet they were not strictly intolerant of others of their kind on their territory, and for a while they permitted a third araçari to sleep not far from them in a hole which they had formerly occupied.

In February, these birds, which I had now watched for a year, took possession of a hole which had been abandoned by a pair of Pale-billed Woodpeckers after they had lost their newly hatched nestlings to a predator. In this low hole the pair of araçaris slept together, with occasional inexplicable absences in true araçari style, until the female laid in it at the end of March. Now, as in the preceding year, a single parent slept in the nest, while the other took up quarters once more in the trunk of the *Cecropia* where formerly both had found shelter. This time the nest was pillaged even before the eggs hatched (see section on eggs and incubation). Still, the araçaris did not abandon the clearing where, in two successive years, they had been unable to rear a brood. As after the loss of their nest in the previous year, both now slept in the dormitory of the member of the pair which had not incubated by night, in this case the low hole in the *Cecropia* trunk that had so long been their shelter. Again I could detect no attempt to replace their lost eggs. In mid-June I left the locality, and my observations of this pair, which had lasted more than 15 months, came to an end.

Eggs and incubation.—I made no attempt to reach the hundred-foot-high hole in which this pair nested in 1936. However, the following year, when they used a hole only 20 feet high, I constructed a ladder and climbed to the nest on April 1. When the interior was illuminated with an electric bulb, my mirror, thrust through the doorway, revealed two pure white eggs resting on a layer of regurgitated seeds which covered the whole floor and looked much like a bed of assorted beans. Since I could barely touch these eggs with my finger tips, I did not jeopardize future studies by trying to remove them for closer examination and measurement. These are the only eggs of the Fiery-billed Araçari that I have seen or of which I can find a record.

I gave some attention to the mode of incubation in both years. Because I am not certain whether, in araçaris, the nest is occupied through the night by the female, as in most birds, or by the male, as in a number of cuckoos, woodpeckers, and puff-birds, I shall designate as A the member of the pair which slept on the eggs and as B the mate that lodged in a neighboring hole. In 1936 I noticed that the early morning behavior of these araçaris varied considerably from day to day. On April 4, bird A left the nest and flew into the woods at 5:28 a.m., returning to the eggs ten minutes later. Bird B did not emerge from its dormitory until 5:42 a.m., at which time it flew directly into the forest. The following day, however, B flew from the dormitory to the forest at 5:20 a.m.; A remained in the nest until B returned and entered it at 5:44. On April 12, B left the dormitory at 5:32 a.m.; A emerged from the nest at 5:45 but perched in front of it until B came to take charge of the eggs a minute later. Often, as B flew from the old woodpecker hole in the morning, it was pursued as far as the forest by one or both of the tityras whose nest was in the same trunk. Sometimes the tityras also chased B as it came to its lodging in the evening.

In addition to these early morning vigils, I watched this nest while incubation was in progress from 5:18 to 10:38 a.m. on April 5, and from 2:12 to 6:06 p.m. on April 7. Araçari A left the nest at 5:44 a.m. on April 5; on April 7 it entered for the night at 5:25 p.m. In the slightly more than 8 hours during which changes in the occupancy of the nest took place while I watched, I timed 12 sessions by both parents. These ranged

from 2 to 102 minutes in length and averaged 25.6 minutes. Only one session, in the afternoon, was over an hour in length. Since I could not distinguish the parents, it was impossible to tell how nearly equally they shared in the task of incubation. The change-overs were witnessed most frequently in the early morning, and when they occurred the newcomer often entered the nest before the other emerged. Sometimes the incubating bird left the hole, perched in front of it for two or three minutes, and then went in again. Once one member of the pair did this three times in the course of 81 minutes, breaking what might have been one long session into four shorter ones of 24, 21, 21, and 7 minutes. These sessions were counted separately in computing the average attendance period. The result of all this restlessness was that the nest was left unattended for 11 periods ranging from 2 to 53 minutes in length and averaging 15.9 minutes. The eggs were incubated for only 63.6 per cent of the 8 hours.

On April 9 of the following year, I watched the lower nest of the same pair of araçaris from 5:20 to 11:12 a.m., but since A did not leave the nest until 6:13, this vigil covered only 5 hours of the active period. The araçaris were so restless that neither stayed at its post until the mate arrived, and I did not witness a single change-over. Once, however, one partner came to the doorway while the other was within, but it flew off again as the latter tried to push out past it. Doubtless both sexes participated in incubation as they had in the previous year. Seven sessions ranged from 12 to 53 minutes and averaged 28.1 minutes. An equal number of periods when the eggs were unattended ranged from 2 to 31 minutes and averaged 14.6 minutes. The eggs were covered 65.9 per cent of the 5 hours. The two records, made in different years, are surprisingly similar, especially when one considers only the earlier part of the record made in 1936. In that year, between 5:44 and 10:38 a.m., the eggs were covered a total of 199 minutes and were unattended for 95 minutes, whereas in 1937, from 6:13 to 11:12 a.m., the corresponding figures were 197 and 102 minutes.

In the Costa Rican highlands, I found the Blue-throated Toucanet only slightly more constant in incubation (Skutch, 1944:140). One wonders why araçaris, taking turns on the nest, should sit so inconstantly that the two parents together keep their eggs covered less constantly than many small female passerines that incubate alone. Compared with other non-passerines of about the same size, including pigeons, trogons, motmots, kingfishers, puff-birds, and others, whose sessions on the eggs usually last for hours, araçaris, like other toucans, make a poor showing. The contrast between the araçaris and the Pale-billed Woodpeckers, which earlier had occupied the same hole used by the araçaris in 1937, was especially striking; the woodpeckers kept their eggs almost constantly covered, with only two change-overs in a whole day's watching. The only explanation which I can offer for the araçaris' inconstant incubation is temperament. They are restless birds, and their behavior contrasts strongly with that of trogons, puff-birds, and kingfishers, which are more phlegmatic. Perhaps for this reason they find it difficult to remain sitting quietly in the narrow chamber. However, jays and jacamars, also vivacious birds, stay on their eggs for long periods, so that additional factors appear to be involved in determining the constancy of incubation.

When approaching their nest, the araçaris frequently carried some small object in the end of their great bill. Sometimes they dropped this before going to their eggs and at other times they took it inside. When they thrust their heads through the doorway or flew from the nest, they likewise often held something in the bill, only to let it fall after a short time. These objects were probably the regurgitated seeds of forest fruits which were very prominent on the floor of the low nest. During my afternoon vigil in 1936, a family of four Red-crowned Woodpeckers, including two young ones which had recently left a nest in a neighboring dead trunk, climbed and pecked over the ara-

çaris' nest tree. The young male cautiously peered into the hole where one of the toucans was incubating. Later, when the nest was unattended, he went again to the orifice and after much hesitation entered but emerged a moment later. Apparently he was prospecting for a dormitory since he was inside hardly long enough to harm the eggs.

At dawn on April 10, I found that the araçaris' eggs had vanished from the low nest. Apparently they were taken during the night by the same predator that had enlarged the entrance to the hole of a pair of Golden-naped Woodpeckers a little higher in the same trunk and carried off their nestlings. Although the parents survived and continued to roost in the clearing, no attempt at renesting was noted, just as none had been made after the loss of the nestlings in the preceding year. Araçaris are not only single-brooded, but unlike many other single-brooded birds they seem to make no second attempt to reproduce if their first effort is unsuccessful. Van Tyne (1929:34) concluded that the Keel-billed Toucan is single-brooded, but the Blue-throated Toucanet rears two broods in a season.

The young and their return to the nest.—By April 16, 1936, the araçaris were bringing food to the high, inaccessible nest. The small insects which they now carried in the tip of the bill contrasted with the large, regurgitated seeds, which at an earlier stage they had often held, and they were far more difficult to see. Early in the morning of April 22, a flock of five araçaris flew into the clearing and were joined by the nesting pair, making seven in all. Some of the newcomers came near the nest, but they did not actually visit it. Although I saw no quarreling between the residents and the visitors (I have never seen araçaris fight), I sensed tension, and after the whole party went to perch at the forest edge, I heard sounds suggestive of a dispute. But before I could get a clear view of the araçaris, the momentary flare-up had subsided, and soon the visitors vanished. A week later I found that the nest tree had been felled, apparently to take the nestlings, if they survived the fall of well over a hundred feet as the tree crashed down the steep slope. At no time did I see more than two adults in attendance at this nest.

The third and last nest was situated about 45 feet above the ground in an old hole in a tall, branching, fire-killed tree standing in a newly made pasture. This cavity had probably been carved by a Lineated Woodpecker. When I found it on April 24, 1943, the parents were feeding nestlings. This nest was in plain view of the main road from San Isidro to Quizarrá, and perhaps for this reason the araçaris were far more shy than were those in the more secluded clearing where I had found the first two nests. I could watch the parents approach the nest only if I stationed myself a long way off, behind screening bushes. They brought insects, fruits, and once a newly hatched nestling of a passerine bird. I saw no indication that other individuals were assisting them in the care of the young. By May 7 the young had begun to look through the doorway; at times two birds looked out at the same time. Their bills were already of considerable size. Both parents now slept in the nest, but if they saw me watching them, even a long way off, they would, unlike most other araçaris that I have observed, go elsewhere to spend the night.

Early on May 10, I saw only one nestling in the doorway, and continued watching convinced me that the other had flown. By the evening of the following day, the second young bird had not yet emerged. While it looked through the doorway, both parents flew down from the neighboring forest to alight in a small dead tree standing near the nest. They were excited and called *pitit pitit* in high, sharp voices, at the same time twitching their great bills up and down. Presently the fledgling which had emerged on the preceding day came down from the forest to join them. It flew fairly well but made a c'umsy landing and hung for a moment below the branch before it succeeded in right-

ing itself. One of the parents entered the nest but promptly returned to the lower tree where the young bird rested. Soon an adult went into the hole to stay, while the other flew to a more distant tree. Left alone, the fledgling started toward the nest, only to veer to one side of the trunk and continue its flight unbroken to the forest edge. There it remained for its second night in the open. Later the other parent retired into the nest. Thus, on this night the two adults slept in the hole with the remaining nestling, while the more advanced young bird was exposed to the elements.

Continuous rain interfered with observations on the evening of May 12, but at dawn on the following day there were two adults and two young in the nest. Thus it was evident that one of the latter had succeeded in entering the hole after two nights outside. This young bird left the nest 42 minutes after its parents and with little difficulty flew to the nearest part of the forest. Until six o'clock the second young araçari stayed inside and called *pit pit* in a high, slight voice, in answer to the reiterated *pitit* of its parents from the margin of the forest. I then went to breakfast, but when I returned at seven o'clock I found that the second fledgling had flown forth and was resting on a fallen charred log between the nest and the woodland. The parents' excited behavior had revealed its position, and I approached quite close before it tried to escape. It flew with directness and force but gained altitude with difficulty, and since the slope ahead was inclined more steeply than the young bird could rise, its course ended abruptly in the deep calinguero grass, among the charred logs and stumps 50 feet from its starting point. Advancing cautiously, I captured it by throwing my hat over it, while the parents looked down from the dead trees with obvious concern. Taken in hand, it struggled forcefully to escape and once bit hard enough to hurt. After I had written a description of it, I released the young araçari, and it resumed its journey to the forest. It had left the hole three days later than its nest-mate, and after its departure the nest cavity was empty.

During a lull in the afternoon rain at 5:06 p.m. on the same day, I found that one young bird, doubtless the older, had already returned to the nest and was looking through the doorway. Half an hour later both parents flew down from the forest, and soon they were followed by the other young araçari, whose skill on the wing had improved noticeably during its first day in the open. Presently one parent entered the hole, and then the young one tried to follow. But it aimed too high and clung to the trunk above the doorway. While it rested there, the other parent slipped into the hole below it without giving the least encouragement. After another unsuccessful attempt to join the others in the hole, the young araçari started off toward the forest but came down among the charred logs and stumps in the pasture, where I lost sight of it in the drizzle and gathering gloom. A few moments later both parents emerged from the dormitory and flew toward the young bird but passed above it to the forest, where they remained until it was dark. Thus the more advanced fledgling slept alone in the nest cavity, while the younger of the two, repeating the experience of the other, was obliged by its inadequate power of flight to sleep in the open on its first night out of the nest. The following evening, May 14, none of the family came in sight of the nest tree between 4:30 p.m. and nightfall. The hole remained deserted. Probably the parents had taken little trouble to guide the fledglings into the nest because they were themselves ill at ease in this exposed situation.

The newly emerged fledgling which I had in my hand rather closely resembled the adults in plumage, although its colors were slightly duller. Its bill was far less colorful, the upper mandible being yellow clouded with dusky, with the culmen blackish at the base and greenish toward the center of its long axis. The lower mandible was dusky, but both parts of the bill were brighter yellow at the tip. The inside of the bill was yellow.

The iris was straw-color instead of bright yellow as in the adults. The bare skin surrounding the eye was bright yellow behind the orbit (this area is red in the adults), greenish-yellow above it, and greenish in front, on the lores. The legs and feet were yellowish-green, with black toenails. The heel pad, characteristic of nestlings which grow up in unlined holes in trees or banks, was still quite evident in the form of five prominent protuberances in a ring surrounding each heel.

Araçaris as neighbors.—Although the araçaris are undoubtedly fond of eggs and nestlings, they do not systematically prey upon the other birds that breed in holes in the vicinity of their own nests. The inspection of a large share of the cavities in a clearing with dead trees appears to be carried out chiefly by the parties of nonbreeding birds which wander about at all seasons, and by mated pairs looking for a nest site and a lodging. After the pair of araçaris which I watched in 1936 and 1937 had become comfortably established, I did not see them give attention to any holes other than the two in which they nested and slept.

I have on numerous occasions known other hole-nesters, including Masked Tityras, Gray-breasted Martins, Golden-naped Woodpeckers, Red-crowned Woodpeckers, and Lineated Woodpeckers, to rear their families within sight of an araçari nest and often in the same tree with it. The immunity of the smaller woodpeckers might be attributed to the depth of their nest holes combined with the narrowness of the doorway, which places the eggs beyond reach of the araçaris' bills, whereas the safety of the brood of the Lineated Woodpecker may be due to the rather constant guard kept by the parents. Neither of these explanations, however, would account for the immunity of the tityra and the martin, which often nest in old holes, the doorway of which is wide enough to admit an araçari. The only instance of predation on a hole-nesting bird that I have witnessed was the removal of a single egg from a nest of a Golden-naped Woodpecker. The cavity of this nest was perhaps shallower than usual, for the toucan managed to seize the egg while clinging to the front of the doorway. Yet in this same hole, only a yard above an occupied nest of the araçari, the woodpeckers succeeded in hatching one or more remaining eggs. Although all of these hole-nesters are fearful of the araçaris and are greatly perturbed whenever they approach, the latter are not such dangerous neighbors as their predatory habits might lead one to suppose.

SUMMARY

The Collared Araçari inhabits the lowland forests of Central America from sea level up to about 3000 feet, where it roams through the tree-tops in straggling bands containing up to six or rarely more individuals. It subsists largely on fruits. Its notes are thin, high-pitched, and of limited variety.

These araçaris roost in old woodpecker holes or in cavities resulting from decay. The greatest number of araçaris found sleeping together was six. These birds retire late in the evening and arise early. Each band appears to know a number of available dormitories, and with slight provocation they shift from one to another.

At the end of February, six araçaris were found lodging in a hole about 100 feet up in a great tree on Barro Colorado Island, Panamá Canal Zone. In March this cavity was taken over for breeding, and for most or all of the period of incubation a single bird slept in it. But at about the time the eggs hatched, most of the original flock returned to roost each night with the nestlings.

All five of the full grown birds which slept with the nestlings helped to feed them. These attendants probably consisted of the parents and three helpers that were too young to breed. At first the attendants brought small insects but, as the nestlings grew, they brought an increasing proportion of fruits, including many seeds of *Virola*. The attendants were also seen to remove large amounts of waste from the nest.

The nestlings, of which there were at least three, first appeared in the opening of the nest holes when they were about 37 days old. They left on different days, 43 to 46 days after the attendants were first seen bringing food to the nest.

The Fiery-billed Araçari differs from the Collared Araçari chiefly in the more vivid color of its bill. It occurs in a restricted region on the Pacific side of southern Costa Rica and western Panamá, breeding from sea level up to at least 3000 feet. This araçari subsists on a variety of fruits, with the occasional addition of the eggs and nestlings of other birds. Its high, weak notes are very similar to those of the Collared Araçari.

In the valley of El General, Costa Rica, these araçaris were frequently found lodging in old woodpecker holes or other cavities in fire-killed trees left standing in new clearings in the forest. Favorite lodging places are the holes made by Lineated Woodpeckers; on two occasions, holes of this species were occupied by araçaris a few days after the nestling woodpeckers left. Five araçaris appears to be the maximum capacity of a Lineated Woodpecker's hole, and larger parties divide up between neighboring cavities. Each flock seems to have several dormitories, and they often shift from one to another, so that the occupancy of a single cavity fluctuates.

The sleeping arrangements of a single pair were followed over a period of 15 months which included two breeding seasons. While incubation was in progress, one member of the pair slept on the eggs and the other lodged alone in a neighboring cavity. Between breeding seasons the two slept together, often in their nesting territory, although from time to time they went elsewhere as is usual with araçaris.

In the breeding season, parties of nonbreeding araçaris wander about. Apparently these birds do not nest until they are nearly two years of age, or older. These unmated birds were not seen to help mated pairs attend nestlings, as has been noted in the Collared Araçari.

Each year the female of the mated pair laid eggs at about the end of March. Once the eggs were deposited in a hole about 100 feet high and once they were laid in a hole only 20 feet high that had been made by a Pale-billed Woodpecker. The lower hole contained two immaculate white eggs which were found resting on a bed of regurgitated seeds. Both sexes incubated, but they sat so restlessly that, except in the early morning, change-overs on the eggs were rarely witnessed. The periods of incubation of both sexes averaged 25.6 minutes the first year and 28.1 minutes the second year. A period of 102 minutes was the only session longer than one hour that was observed. In the first year, the eggs were covered only 64 per cent of eight hours and in the second year 66 per cent of five hours. The first nest was destroyed by men who felled the nest tree, and the second was destroyed by a predator.

At a third nest, both parents slept with the feathered nestlings. The newly emerged fledglings tried to return in the evening to roost with their parents. This nest contained at least two young, the first of which left three days before the second.

In El General, a single brood is reared yearly. In two instances when eggs or young nestlings were lost, no attempt at renesting was noticed.

Although these araçaris take the eggs and nestlings of other species, smaller hole-nesting birds often successfully rear their young in the same clearing and even in the same dead tree in which araçaris nest. The immunity of some smaller birds from predation by the araçaris can be accounted for neither by the inaccessibility of their eggs nor by the effectiveness of their defense. It is to be attributed rather to the araçaris' lack of interest in these nests.

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EFFECTS OF HABITAT DETERIORATION ON BIRD POPULATIONS OF A SMALL UTAH MARSH

By MILTON W. WELLER, BILLY H. WINGFIELD, and JESSOP B. LOW

The effects of changing habitat on the abundance and species composition of populations of waterbirds have often been noticed but seldom measured. Bennett and Hendrickson (1939) presented data indicating an increase in the number of species present in northwest Iowa after drainage. However, their comparative data were weak and the magnitude of the change was uncertain. Marshall (1952) and Evans and Black (1956) reported reduction in waterfowl numbers in potholes due to drought in Minnesota and South Dakota, respectively, and Johnsgard (1956) showed a reduction in waterfowl abundance and changes in species composition as a result of the flooding of potholes in Washington. The present paper reports the effects of grazing and reduced water on a small marsh in Utah. Populations and productivity of the Knudson Marsh were studied by Wingfield in 1950 (Wingfield and Low, 1955). After several years of reduced water supply because of increasing irrigation demands and reduced rainfall, populations were studied in 1955 by Weller. Low maintained observations during the intervening years and in 1956. During the course of this study, financial assistance was received from the Delta Waterfowl Research Station, the Wildlife Management Institute, and the Missouri and Utah Cooperative Wildlife Research units.

DESCRIPTION OF THE AREA

The Knudson Marsh is four miles west of Brigham, Utah, in the alkaline silt flats at the mouth of the Bear River, in Great Salt Lake Valley. It is privately owned and lies one and one-half miles from Unit 5 of the Bear River Migratory Bird Refuge and one mile from the nearest house and road. The marsh contains approximately 250 acres and is divided into two units connected by several channels. The lower section is smaller and contains relatively little vegetation for nesting; only the upper section is considered in detail in this paper. The upper marsh consists of 174 acres: 120 acres of vegetation and 54 acres of water. Fresh-water plants dominate because of leaching of the saline soil by fresh water from the nearby Wasatch Mountains (Nelson, 1954). Important plant species (names from Holmgren, 1948) and their percentage of the total vegetation in 1950 were: hardstem bulrush (*Scirpus acutus*), 56 per cent, Olney's bulrush (*Scirpus olneyi*), 24 per cent, cat-tail (*Typha latifolia*), 12 per cent, saltgrass (*Distichlis stricta*), 7 per cent, alkali bulrush (*Scirpus paludosus*), 1 per cent, and cane (*Phragmites communis*), trace.

Channels of water surround and dissect the marsh and many small and large bodies of water are scattered throughout the vegetation. During years of normal rainfall, the speed of mountain run-off is reduced by an irrigation dam in the mountains, and water fluctuation in the marsh is not usually severe. Fluctuations occurred chiefly following rains; a maximum rise of three inches was recorded in one 24-hour period in 1955. The water level of the marsh is partly regulated by natural topography and partly by a low, earthen dam constructed by the owners to improve the marsh. However, diversion of water for irrigation in recent years has reduced the size of the marsh. Water levels fell gradually throughout the season in both 1950 and 1955.

The sparse vegetation of the surrounding mud flats is principally saltgrass, glasswort (*Salicornia rubra* and *S. pacifica*), and greasewood (*Sarcobatus vermiculatus*). The saltgrass was heavily grazed by cattle.

BIRDS OF THE MARSH

Table 1 shows the species and abundance of common birds nesting in the upper marsh during 1950 and 1955. In addition, the Long-billed Marsh Wren (*Telmatodytes palustris*), Yellow-headed Blackbird (*Xanthocephalus xanthocephalus*), and Redwinged Blackbird (*Agelaius phoeniceus*), which nested in the marsh in 1950, were found in abundance only in the lower section in 1955, because of the reduction of high and dense emergents in the upper marsh. The following species nested on the flats surrounding the marsh: Snowy Plover (*Charadrius alexandrinus*), Long-billed Curlew (*Numenius americanus*), Avocet (*Recurvirostra americana*), Black-necked Stilt (*Himantopus mexicanus*), Wilson's Phalarope (*Steganopus tricolor*), and Black-billed Magpie (*Pica pica*).

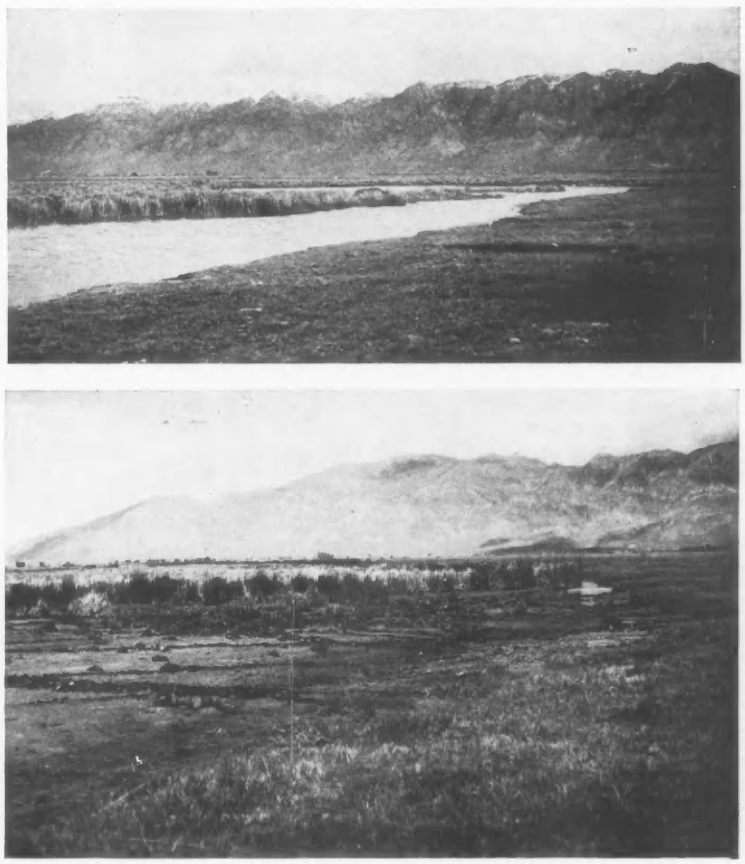

Fig. 1. Above: channel of water between grazed saltgrass flats and marsh on April 29, 1955. Below: the same channel on May 27, 1955, showing cattle trails and marginal growth of Olney bulrush.

Transient or occasional visitors to the marsh were: Eared Grebe (*Podiceps caspicus*), White Pelican (*Pelecanus erythrorhynchos*), Whistling Swan (*Olor columbianus*), Shoveler (*Spatula clypeata*), Common Goldeneye (*Bucephala clangula*), Bufflehead (*Bucephala albeola*), Golden Eagle (*Aquila chrysaëtos*), Peregrine Falcon (*Falco peregrinus*), Common Snipe (*Capella gallinago*), California Gull (*Larus californicus*), Violet-green Swallow (*Tachycineta thalassina*), and Common Raven (*Corvus corax*).

Predatory species were the Peregrine Falcon, which killed White-faced Ibis (*Plegadis chihi*) while the latter were feeding in the marsh, and the California Gull and Black-billed Magpie, which ate duck eggs. Striped skunks (*Mephitis mephitis*) were also present in the marsh, and undoubtedly preyed upon the eggs and young of marsh birds. The California Gulls were few in number but were highly efficient in finding nests that had been exposed because of the investigators' presence. Magpies were most destructive late in the summer when family groups entered the marsh and moved around through the vegetation, apparently in search of eggs.

HABITAT CHANGES

In April, 1950, water in the marsh vegetation was one to 12 inches deep. Most duck nests were constructed over water one to six inches deep. In late May and early June, the northern portion of the marsh, where the vegetation was chiefly Olney's bulrush, dried up. However, the channels and pools remained full. Hardstem bulrush was six to 12 inches tall by late April and reached a height of six to ten feet over the entire marsh by mid-June. This plant was so dense that walking through it was nearly impossible.

Three adverse conditions operated to reduce water levels in the Knudson Marsh: first, due to natural deepening of the water channel entering the Bear River Refuge, less water was pushed into the channel entering the Knudson Marsh; second, increasing demands for irrigation water decreased the total water available for the marsh; and third, lower than normal rainfall was recorded over the period of study. The average annual rainfall data for Utah show that rainfall was below normal in 1952, 1953, and 1954.

By 1955, the marsh was strikingly different from its lush condition in 1950. In late April, almost no vegetation was standing in water and only the channels and potholes were full. Patches of saltgrass, which had been flooded with six to 12 inches of water in the early spring of 1950, were merely soggy in 1955. Virtually no duck nests were constructed over water as is shown by the following comparison of the depth of water at the bases of the nests of the Redhead (*Aythya americana*) in 1950 and 1955.

	1950	*1955*
No water	29	41
1–3 inches	73	1
4–6 inches	17	0
7–13 inches	3	0
Total nests	122	42

By the end of May, water in the shallower channels had dried up (fig. 1) and by early July, even the main body of open water had receded (fig. 2). Lack of water during the growing season seriously affected both the height and density of plant growth. However, no distinct change in plant acreages was apparent as a result of this water shortage. Hardstem bulrush developed more slowly and reached only six inches in height by late April, as opposed to 12 inches in 1950. The maximum height of six feet was reached in late June and this developed only at the edges of pools and channels. Even by mid-July, the new plant growth was insufficient to change the marsh entirely from winter brown

Fig. 2. The main pool of the Knudson Marsh on July 12, 1955. Notice the old and new hardstem bulrush which has been trampled or eaten by cattle.

to green. The effect of cattle grazing on the vegetation was as serious as the lack of water. Cattle rarely entered the marsh in 1950, but their use of the area increased from 1951 to 1955 when the dried-up channels around the marsh edges permitted their entry. By April, 1955, the plant growth of the previous season had been broken up or flattened by cattle. As the channels dried up further, cattle not only entered the marsh but remained there for many days at a time. Old plant growth was trampled and new green bulrush was eaten (fig. 2). Occasionally cattle destroyed duck nests by trampling.

CHANGES IN BIRD POPULATIONS

The reduction in the numbers and species of birds from 1950 to 1955 is shown in table 1. Species which preferred deep water, such as Pied-billed and Western grebes, disappeared. Colonial species, such as Black-crowned Night Herons, egrets, and ibises left the marsh entirely, while Great Blue Herons seriously declined in numbers. One colony of Black-crowned Night Herons was present in the lower marsh but comparative numbers for the entire marsh for the two years are not available. An intensive one-day survey by Low and a crew of 25 men on July 16, 1956, revealed no nests of ibises, egrets, or Black-crowned Night Herons in the upper marsh. Marsh Hawks were seen in the area during the courtship period in 1955 but none nested, probably because the limited grassy areas had been trampled by cattle.

The most extensive data are for ducks and geese, in which there was a 60 per cent decline from 790 nests in 1950 to 324 nests in 1955. Even further declines were indicated in the 1956 survey. The decrease in the abundance of most species of ducks is shown in both pair-counts and in the number of nests found. The Ruddy Duck was the most seriously affected by the lack of water in the upper marsh, declining from 25 nests in 1950 to one nest in 1955. No nest of this species was found in 1956. The number of Canada

Goose nests has been declining for several years. During 1940 and 1941, Cecil S. Williams (*in litt.*) found 146 and 144 nests, respectively. In 1950 only 30 nests were found, while in 1955, approximately 25 were located. The survey in the summer of 1956 revealed the remains of only two nests, one of which was unsuccessful. The Gadwall, a bird of dry land nesting habits, increased slightly from 1950 to 1955.

DISCUSSION

The Knudson Marsh once held a population of birds which few marshes of its size could rival, either in numbers or variety. Most spectacular were the populations of Ana-

Table 1

Nesting Birds of Knudson Marsh, Boulder County, Utah, 1950 and 1955

Species	Number of nests		Per cent of change in number of nests
	1950	1955	
Pied-billed Grebe (*Podilymbus podiceps*)	3 nests	No nests, no birds	—100
Western Grebe (*Aechmophorus occidentalis*)	1 nest	No nests, 1 bird	—100
Great Blue Heron (*Ardea herodias*)	65 nests	5 nests	—92
Snowy Egret (*Leucophoyx thula*)	Colony present, number of nests unknown	None nesting	—100
White-faced Ibis (*Plegadis chihi*)	Colony present, number of nests unknown	None nesting	—100
Black-crowned Night Heron (*Nycticorax nycticorax*)	Colony present, number of nests unknown	None nesting	—100
Canada Goose (*Branta canadensis*)	30 nests (estimated)	25 nests (estimated)	—19
Common Pintail (*Anas acuta*)	16 nests	9 nests	—43
Green-winged Teal (*Anas carolinensis*)	No nests	1 nest	——
Mallard (*Anas platyrhynchos*)	390 nests 450 pairs	171 nests* 125–150 pairs	—56
Gadwall (*Anas strepera*)	6 nests	11 nests	+45
Cinnamon Teal (*Anas cyanoptera*)	172 nests 300 pairs	57 nests 60 pairs	—67
Redhead (*Aythya americana*)	151 nests 500 pairs	49 nests 95 pairs	—68
Ruddy Duck (*Oxyura jamaicensis*)	25 nests 50 pairs	1 nest 2 pairs	—96
Marsh Hawk (*Circus cyaneus*)	2 nests	No nests	—100
Ring-necked Pheasant (*Phasianus colchicus*)	2 nests	2 nests	0
American Coot (*Fulica americana*)	77 nests	40–50 nests (estimated)	—36

* More nests than pairs, due to numerous nesting attempts.

tidae: 6.6 nests per acre of vegetation were found in 1950, and even in 1955 there were 2.7 nests per acre. Few comparable data are available, but Williams and Marshall (1938) found only one nest per acre in a large study area in the famous Bear River Refuge. Thus it appears that only on islands (Hammond and Mann, 1956) are there records of a greater density of duck nests per acre of vegetation than found in the Knudson Marsh. These impressive populations may be attributed to two factors. First, water was well interspersed with vegetation, allowing dispersion of birds into many small scattered water areas with minimal territorial friction. Second, under normal water conditions, the marsh is surrounded by a channel of water 3 to 50 feet wide and 1 to 5 feet deep. Thus, in effect, it is an island-like habitat and predation by skunks occurs only when channels dry up. During years of normal marsh conditions, survival is apparently greater than that on the mainland and a relatively large population results (Hammond and Mann, 1956).

This little marsh is an area of unique importance. Clarence Cottam, formerly Assistant Director of the United States Fish and Wildlife Service, recently stated (*in litt.*): "I regarded the Knudson Marsh as one of the outstanding small marsh areas that I had ever visited . . . ." The deterioration of such a marsh is a great loss to ornithologists and conservationists. Its value lies not only in its productivity of ducks and geese but in its potential as a breeding area for the rarer wading birds.

The decline of one-third in the number of species and two-thirds in the number of birds nesting in the Knudson Marsh represents a loss during a period of only five years, the result of intensive grazing, diversion of water, and short-term drought. The quality of the Knudson Marsh warrants protection from both grazing and adverse water conditions. Similar conditions exist in other small marshes in the Great Basin. The purchase of such critical areas is often impossible, but long-term leases, cattle fencing, and inexpensive water control structures might preserve and maintain their productivity.

SUMMARY

Bird populations of a small Utah marsh were studied intensively during 1950 and 1955. During 1950, the vegetation was lush and held large populations of ducks, geese, and wading birds. Nests of Anatidae were most abundant; 6.6 nests were found per acre of vegetation. Colonies of the Great Blue Heron, Black-crowned Night Heron, Snowy Egret, and White-faced Ibis were present.

Drought conditions prevailed from 1952 through 1955, and irrigation demands reduced water available to the marsh. Deterioration of the vegetation from lack of water and intensive over-grazing by cattle was reflected in the bird populations. Duck populations dropped from 6.6 to 2.7 nests per acre and the colonies of all wading birds except the Great Blue Herons disappeared; the latter declined 92 per cent. Especially significant was the disappearance of deep-water species such as the Pied-billed Grebe, Western Grebe, and Ruddy Duck. Only the Gadwall, a bird of dry land nesting habits, increased slightly.

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THE OCCURRENCE AND DISTRIBUTION OF BIRDS ON MIDDLETON ISLAND, ALASKA

By ROBERT RAUSCH

The Prince William Sound region of southern Alaska lies just east of the Kenai Peninsula, and not far from the northwestern limits of the coastal forest zone. Although the avian fauna of this general region is relatively well known, previous studies have not included Middleton Island, which lies in the Gulf of Alaska well to the south of the many islands comprising the archipelago of Prince William Sound (fig. 1). Because of its location, small size, topography, and its vegetational and faunal characteristics, Middleton Island would appear to be of considerable ornithological interest. Also, because of current military activities on this island, the imminent disruption of its natural relationships make it desirable to record as much as possible of its natural history before the opportunity is lost.

In June, 1956, a field party consisting of Dr. Norman J. Wilimovsky, United States Fish and Wildlife Service, Dr. John H. Thomas, Stanford University, and the writer undertook a biological reconnaissance of Middleton Island. The work was supported mainly by the Office of Naval Research and the United States Air Force, but additional support was provided by the Arctic Research Laboratory, Stanford University, and the Arctic Health Research Center. These studies were aided by a contract between the Office of Naval Research, Department of the Navy, and the Arctic Institute of North America. Reproduction in whole or in part is permitted for any purpose by the United States Government.

Over a period of 15 days in the field (June 5 to 15 and June 25 to 28), the writer recorded the species of birds observed and attempted to define the ecological distribution of the breeding species. Insofar as possible, the distribution of the latter was correlated with well-defined plant communities and associated topographic features.

The subspecific determinations of the birds collected were made by Dr. Alden H. Miller and Dr. Frank A. Pitelka, University of California, and by Dr. Herbert Friedmann, United States National Museum. The only specimens collected previously on Middleton Island appear to be those taken by C. H. Townsend, who visited the island briefly in August, 1888. These birds, now in the United States National Museum, have been listed by Ridgway (1893).

GENERAL GEOGRAPHIC AND BIOLOGICAL CHARACTERISTICS OF MIDDLETON ISLAND

Topography.—Middleton Island is approximately five miles long, with a maximum width not exceeding one mile. It lies about 50 miles southeast of Montague Island and 70 miles south of the nearest point on the Alaskan mainland (fig. 1). Its geology and geography have been reviewed recently by Miller (1953:18–21), who described the more prominent topographic features as follows:

"The most striking feature of the island is the steplike character of its surface, which consists of a series of terraces at average altitudes of 10, 45, 65, 85, and 105 feet. Conical to ellipsoidal mounds, as much as 20 feet high and grouped in several rows, rise above the general level of the highest terrace to a maximum altitude of 126 feet. The 10-foot and 45-foot terraces slope off gradually near the north end of the island, merging into the present beach and an area of irregular sand dunes. A low spit of sand and gravel forms the north end of the island.

"Steep sea cliffs, undergoing rapid erosion, form the high-tide shore line around much of the island. Along the east and southeast shore the present sea cliff ranges in height from 10 to 45 feet (pl. 2, A). Along the south shore and southern part of the northwest shore it rises in steps to a maximum height of about 110 feet as it intersects, successively, the 65-, 85-, and 105-foot terraces. Most

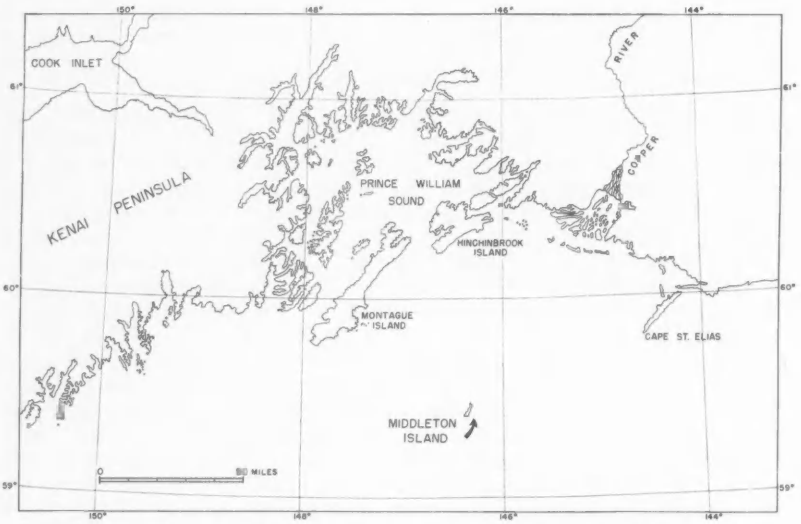

Fig. 1. Map of Prince William Sound region showing the location of Middleton Island.

of the northern part of the northwest shore is flanked by a low cliff at the margin of the 10-foot terrace."

Along the western side of the island are sandy beaches and beach ridges, with a considerable quantity of driftwood. Adjacent to the beach ridges, and extending inland to the base of a steep, west-facing bluff, is a broad, marshy area with several ponds. Most of these ponds are temporary, drying up rapidly after the wet period of early spring. The largest of these ponds, situated near the beach ridge along the northwest end of the island, is temporary and brackish, having a salinity of 388.3 mg./1 in June, 1956. The ponds had a rich plankton, but they contained no fishes. Within this marshy area, there were a number of low mounds. Several small drainages were present along the bluff which bordered the east side of the marsh. A few small drainages were found also on the higher terraces near the south end of the island; one of these dropped rapidly into the sea through a bed of moss-covered boulders. Several large boulders, most of which supported dense vegetation, were scattered about on the high ground at the south end of the island. In this area also, there were occasional small ponds or marshy areas.

Climate.—Middleton Island has a maritime climate with rather moderate temperatures. The average annual temperature for 1956 was 40.3°F.; the average for the warmest month (August) was 53.3°F. and for the coldest (February) −5°F. The total precipitation for 1956 was 51.18 inches, with a departure of −10.3 inches from the long-term mean. High winds are common, especially during the colder months. During the winter, the wind blows mainly from the north and east; during the summer, the prevailing wind is from the southwest.

Mammals.—Fur farming was undertaken on Middleton Island in about 1895, with the introduction of arctic foxes (*Alopex lagopus*) brought originally from the Pribilof Islands. According to Mr. Martin Caping, now employed by the Arctic Health Research Center, who spent the winter of 1921 on Middleton Island, there were from 200 to 300

foxes on the island during the 1920's. Although supplemental feed was provided, particularly in the winter months, the foxes subsisted to a large extent upon birds and other natural food during the spring and summer. Eventually, when fur prices dropped, fur farming was discontinued. As far as can be determined, there have been no foxes on Middleton Island for the last 15 to 20 years.

The extent to which the foxes affected the indigenous fauna of the island cannot now be assessed. The writer found no evidence of any indigenous terrestrial mammals. Detailed examination of the most favorable habitat disclosed no old runways, fecal pellets, nests, or other signs of small mammals. Extensive trapping in selected habitats likewise gave negative results. A few pellets from predatory birds were found around the boulders at the south end of the island, and these contained only avian remains. In discussing the mammalian fauna of the Prince William Sound region, Heller (1910) stated, "It is now quite impossible to determine what species of mammals occurred on the islands that have been used as fox farms for any considerable time." He obtained good evidence that both microtine rodents and shrews had been eliminated from certain islands by foxes. The same thing might have happened on Middleton Island.

In the fall of 1952, domesticated rabbits were introduced by communications personnel stationed on Middleton Island. These animals were fed during the first winter, but they became well established and self-sufficient. In the spring of 1956, they were estimated to exceed 200 in number. At that time, the rabbits were found mainly around the north end of the island, but they will do doubt become more widely distributed if they continue to increase in numbers. Some local damage to the vegetation was noted. According to information provided by Dr. Robert F. Scott, United States Fish and Wildlife Service, 8 to 10 Snowy Owls (*Nyctea scandiaca*) invaded the island in late November, 1957. These birds appeared to be feeding exclusively upon the rabbits, and, if they are not destroyed, they may serve effectively to reduce the rabbit population.

VEGETATION AND DEFINITION OF ECOLOGICAL FORMATIONS

Since the vascular plants of Middleton Island have been studied by Thomas (1957), this discussion is limited mainly to the communities selected in connection with the distribution of the breeding birds. The names of the plants included here are according to the annotated list published by Thomas.

The vegetation is generally low and composed of herbaceous plants. Shrubby willows (*Salix barclayi*) occur over much of the marshy area along the west side of the island, and a few scattered stands are found in the wet areas at higher elevations. A narrow zone made up mainly of large willows borders the steep bluff adjacent to the marshy area along the west side of the island. Spruce trees (*Picea sitchensis*) have become established, but they are widely scattered and would seem to have little importance in connection with the present work. The beach ridge is grown to plants characteristic of this habitat. Over the remainder of the island the vegetation is relatively uniform, except where local variations occur as a result of the effect of moisture and other factors.

For the purpose of the present study, the writer has recognized six major ecological formations. All but one of these are characterized by their vegetation, and their distribution on the island is shown in figure 2. Profiles of the island, showing all six formations, are portrayed in figure 3 (see fig. 2 for location of profiles). The general characteristics of the formations are described briefly as follows:

1. *Upper beach and beach ridge.*—At the north tip of the island was a relatively small area of sand dunes. From here, a well-defined, sandy beach ridge extended along the west side of the island about half-way to the south end. Farther to the south, the beach ridge became less evident, and it finally disappeared, being replaced by a low cut-bank which extended south until it terminated against

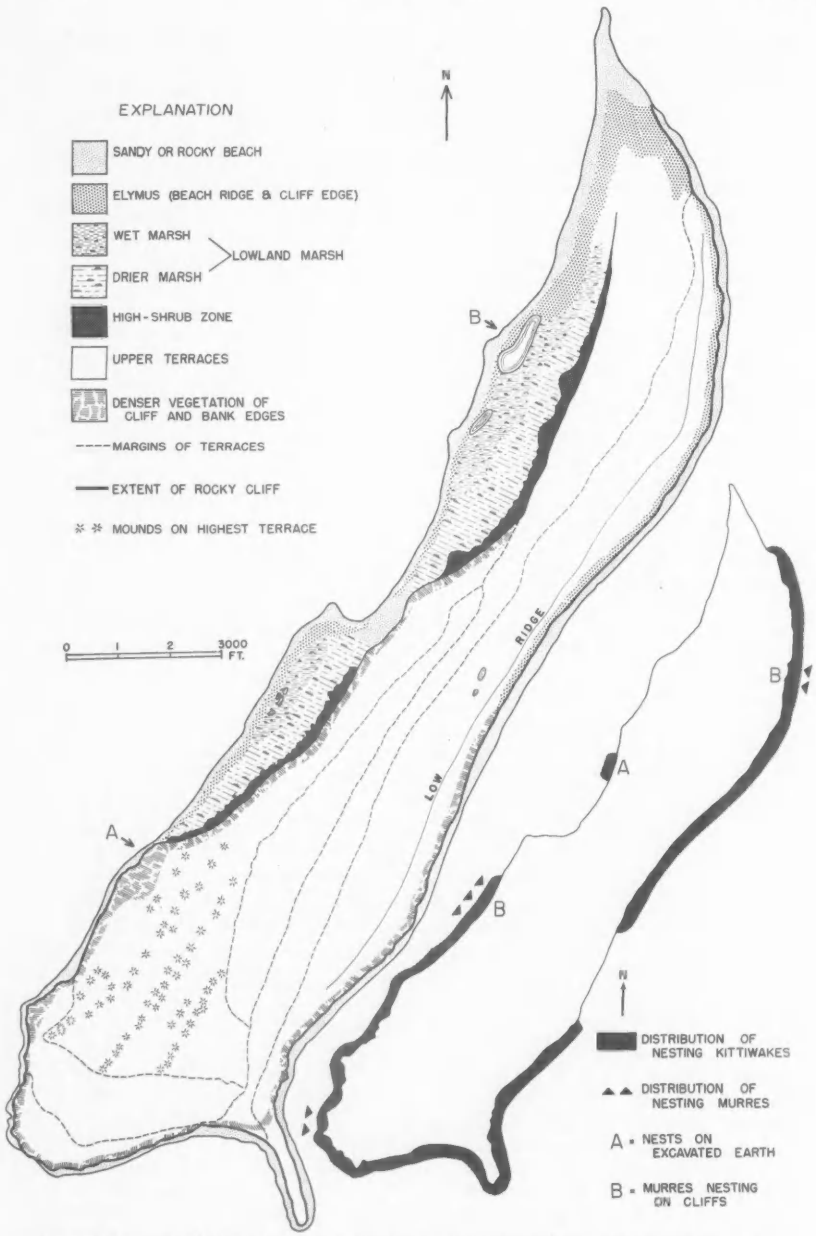

Fig. 2. Left, map of Middleton Island showing ecologic formations and other features. The letters "A" and "B" indicate the points at which the profiles shown in figure 3 were drawn; right, map of Middleton Island showing distribution of nesting kittiwakes and murres.

a steep cliff. Seaward, the beach was sandy or composed of either exposed bedrock or boulders. The upper beach, however, was sandy throughout on the west side, although there were scattered boulders. The predominant plant was *Elymus arenarius* ssp. *mollis*, which grew also along the aforementioned cut-bank. Other important plants here were *Senecio pseudo-arnica, Lathyrus japonicus, Arenaria peploides, Angelica lucida,* and *Fragaria chiloensis. Mertensia maritima* was common along the upper beach. A considerable amount of driftwood had been deposited along the beach ridge and beyond, so that much of it was concealed in the dense growth of *Elymus*.

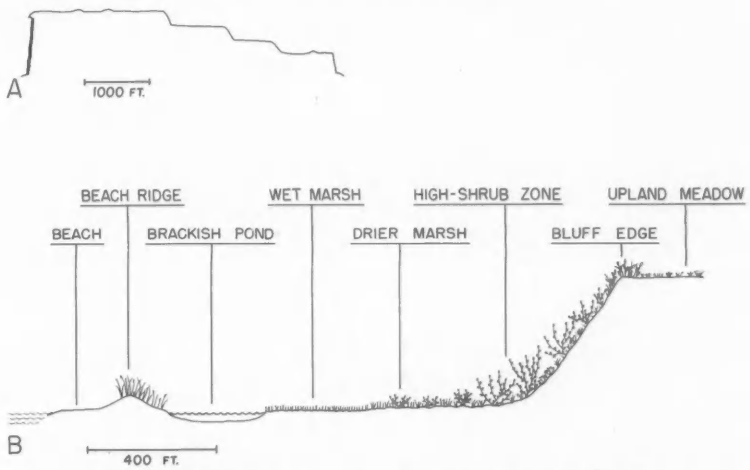

Fig. 3. Profiles of Middleton Island. "A" represents a cross-section of the island, as indicated in figure 2; "B," also indicated in figure 2, depicts four of the major ecologic formations. Vertical scales are much exaggerated.

II. *Lowland marsh.*—The west side of the island was bordered by a rather extensive marshy zone, which was bounded to the east by a steep bluff. It corresponded in area to the lowest of the terraces. Scattered ponds, nearly all situated just inland from the beach ridge, were found here. The aquatic vegetation of the freshwater ponds consisted predominantly of *Potamogeton filiformis* and *Hippuris tetraphylla*. These ponds were surrounded by *Carex lyngbyei* ssp. *cryptocarpa, Polygonum* sp., *Potentilla egedii* var. *groenlandica,* and *P. palustris*. The brackish ponds were surrounded mainly by *Juncus* sp.,*Carex lyngbyei* ssp. *cryptocarpa,* and *Polygonum amphibium*. Inland from the ponds, the wetter areas supported a dense growth comprised largely of *Sphagnum* sp., *Equisetum variegatum, Carex pluriflora, Habenaria* sp., *Caltha palustris* ssp. *asarifolia, Empetrum nigrum,* and *Menyanthes trifoliata. Lysichiton americanum* was locally abundant, particularly along small drainages. East of the ponds near the northwest end of the island were a few low mounds. These were well drained and supported a vegetation essentially like that found on the higher terraces. Small stands of *Salix barclayi* were found here. The eastern part of this area (see fig. 4) was somewhat drier and, in addition to many of the plants listed above, low willows were numerous.

III. *High-shrub zone.*—The base and sides of the bluff bordering the east side of the marsh supported a dense growth of vegetation, in which *Salix barclayi* attained a maximum height of about 10 feet (fig. 4). This bluff originated near the north end of the island, and it increased gradually in height until it terminated against the sea cliff running along the southwest shore. In general, the willows formed a rather dense canopy, and the undergrowth consisted mainly of *Rubus spectabilis, Dryopteris austriaca,* and, in wet areas, *Lysichiton americanum*. In some places, *Rubus spectabilis* formed dense stands. Also present were *Sambucus racemosa* ssp. *pubens, Urtica lyalli, Angelica lucida,* and *Heracleum maximum,* among others.

Fig. 4. Above: view westward from drier marsh to largest pond and beach ridge; isolated spruce in foreground.
Below: view southward along base of bluff; high-shrub zone is sparse here.

IV. *Upland meadow.*—The two highest terraces supported a relatively uniform growth of vegetation (fig. 5); the following plants were abundant: *Calamagrostis nutkaensis, Maianthemum dilatatum, Anemone narcissiflora* ssp. *alaskana, Ranunculus occidentalis* var. *brevistylis, Geranium erianthum, Angelica lucida, Dodecatheon pulchellum,* and *Plantago macrocarpa.* One rather extensive marshy area near the center of the island supported a dense growth of *Eriophorum russeolum* and *Carex* sp. A few small drainages near the south end of the island were bordered by *Caltha palustris* ssp. *asarifolia, Lysichiton americanum,* and *Carex sitchensis.* There were also a few low stands of *Salix barclayi.* The east-facing banks of the terrace margins were grown to most of the species found on the higher

Fig. 5. Above: view across highest terrace, with mounds in background.
Below: top of cliff grown to umbellifers; southern portion of marsh and bluff in background.

terraces, but in addition they supported *Viola* sp., *Rubus stellatus, Cornus suecica, Fritillaria camschatcensis, Castilleja unalaschcensis,* and *Epilobium angustifolium,* among others. The mounds on the highest terrace supported vegetation similar to that of the terrace margins. The lower terrace running along the east side of the island supported a variety of plants. A low ridge paralleling the shore but a short distance inland was grown to vegetation typical of the better-drained situations; common here were *Angelica lucida, Calamagrostis* sp., *Plantago macrocarpa, Geranium erianthum, Dodecatheon pulchellum,* and some *Elymus arenarius* ssp. *mollis.* Adjacent to this ridge was a long marshy zone, grown mainly to *Carex* sp. Small ponds here supported *Hippuris tetraphylla* and *Menyanthes trifoliata.*

Nuphar polysepalum occurred in one pond. There was a rather extensive marshy area at the south end of the island, at the lowest level.

V. *Cliff edge.*—Although its composition was by no means uniform, the vegetation of the cliff edges was chiefly characterized by unusual height and density. This relatively narrow zone was especially well defined along the west side of the island, where it bordered the edge of the bluff and, farther south, the sea cliffs. Here, *Rubus spectabilis* was often predominant, but also present were *Epilobium angustifolium, Calamagrostis* sp., *Geum macrophyllum, Angelica lucida,* and *Heracleum maximum,* among others. In some places, where birds were especially abundant, the umbellifers were predominant (fig. 5), and it appeared that fertilization by the feces of birds had affected the vegetation of the cliff edges. On the east side of the island, this zone was not nearly so well defined, and it differed little from the adjacent vegetation. On the east side, from about mid-way up the island, the cliff edge was bordered by a rather sparse stand of *Elymus* sp.

VI. *Rocky cliff.*—Much of the island is bounded by perpendicular cliffs of varying height. Along the southwest and south end of the island, these are devoid of vegetation. In a few places, slides of earth dislodged by erosion have fallen upon sloping faces and have remained. These usually supported some vegetation. Along the east side, the cliffs were lower, and their structure differed from place to place, there being some areas with a gradual slope as well as perpendicular cliffs of rock. Around the north end, the cliffs were higher and quite precipitous.

THE AVIAN FAUNA

Forty-five species of birds were recorded. Of these, at least 16 were breeding on the island, four were possibly breeding, and the remaining 25 were regarded as transients. For convenience, the breeding and nonbreeding birds are considered separately. The breeding birds are listed according to the major ecologic formations in which they occurred. All names are according to the American Ornithologists' Union (1957).

BREEDING BIRDS

I. UPPER BEACH AND BEACH RIDGE.—*Charadrius semipalmatus.* Semipalmated Plover. This bird was the only species found breeding on the beach ridge, where it was common. It was not observed elsewhere. The plovers regularly showed decoy behavior on June 5, the earliest date on which observations were made. A female collected on June 7 had ova up to 18 mm. in diameter.

Troglodytes troglodytes. Winter Wren. See under Formation III.

II. LOWLAND MARSH.—*Anas acuta.* Pintail. Pintails were frequently observed on the largest pond. Males accompanied by females were seen on June 6 and 10. On June 11, a female and several downy young were flushed a short distance inland from the ponds. On this day also, Dr. John Thomas observed another female with young. None was collected.

Anas carolinensis. Green-winged Teal. A pair of these ducks was observed on the largest pond on June 6. Three adults, including a male, were seen on smaller ponds on June 10, and single birds were noticed from time to time. Although no nests were found, the ducks apparently were nesting in the vicinity of the low mounds just east of the largest pond. None was collected.

Lobipes lobatus. Northern Phalarope. This was a common shorebird, seen daily in favorable habitat. A pair was observed copulating in the water on June 10. Two nests, each containing four eggs, were found on June 12; these were located in dry vegetation not far from the ponds in an area grown mainly to *Carex* sp. and *Potentilla* sp. A female collected on June 25 weighed 31.4 grams; the brood patch had largely refeathered, and molt was beginning.

Capella gallinago delicata. Common Snipe. This bird was seen occasionally in favorable habitat, and its winnowing was heard often in early June. A male, with testis measuring 13 mm., was collected on June 6. No nests were found.

Erolia minutilla. Least Sandpiper. The most abundant shorebird on the island, the Least Sandpiper was seen daily in the drier parts of the marsh. A female collected on June 6 had ova up to 2 mm. in diameter; two males collected on June 7 had testes measuring 3 and 7 mm. long, respectively. Although the behavior of these birds clearly indicated that they were breeding, no nests were found.

Passerculus sandwichensis anthinus. Savannah Sparrow. See under Formation IV.

III. HIGH-SHRUB ZONE.—*Troglodytes troglodytes.* Winter Wren. The Winter Wren was common

throughout this formation, in which it attained its maximum abundance. The males frequently sang from the tall stalks of *Rubus spectabilis* or from dead willow branches. Because of the density of the vegetation, they were not easily observed. No nests were found. Of the several females collected, all showed well-developed brood patches. Along the beach ridge (Formation I), a few wrens were found nesting in driftwood which was concealed in *Elymus* opposite the largest pond. Two birds were collected here on June 25; a male weighed 10 grams, with testis 7 x 4 mm., and a female weighed 9.2 grams, with follicles up to 1 mm. in diameter. In Formation V, these birds were frequently seen along the west side of the island, where the males sometimes sang from the stalks of *Rubus spectabilis*. The wrens were rarely seen along the south end and east side of the island, where the composition of the vegetation was much different.

Dendroica petechia rubiginosa. Yellow Warbler. This was one of the characteristic birds of the shrub formation. It was abundant, and the males were often observed singing from dead willow twigs. They also sang in the shrubby willows adjacent to this formation. Nine specimens were collected, of which six were males. All were in breeding condition. C. H. Townsend collected three specimens on Middleton Island in 1888.

Acanthis flammea. Common Redpoll. Although uncommon, the redpoll may have nested on the island. One was observed in flight on June 6. On June 11, a male in full breeding plumage responded to "squeaking" and perched within a few feet of the writer, too close to permit its being shot. The high-shrub zone closely resembled the typical breeding habitat of the redpoll.

Passerella iliaca sinuosa. Fox Sparrow. Next to the Savannah Sparrow, the Fox Sparrow was the most numerous passeriform bird on the island. It was closely restricted to the zone of high shrubs and its borders. Although generally shy, the birds often could be called in. The males sang from the tops of the higher willows, or from the high stalks of *Rubus spectabilis* along the upper bluff. Ten specimens were collected. A female shot on June 9 contained a fully-developed egg in the lower oviduct. Fox Sparrows were often observed in Formation V, particularly along the edge of the bluff where the vegetation was contiguous with the dense growth on the side of the bluff. Farther south, near the beginning of the sea cliff, Fox Sparrows were common in a relatively wide zone of vegetation. Foraging and singing were observed here, but there was no evidence of nesting. Two of these birds were collected on Middleton Island by Townsend in 1888; the specimens were later studied by Grinnell (1910).

Spizella arborea ochracea. Tree Sparrow. On June 28, two male Tree Sparrows were collected along the west edge of the high-shrub zone, opposite the largest pond. One bird weighed 18.5 grams and the other 18.9 grams; in both, the testes measured 7 x 4 mm. This species may breed on Middleton Island, but it was uncommon at the time of these observations.

IV. UPLAND MEADOW.—*Passerculus sandwichensis anthinus*. Savannah Sparrow. Savannah Sparrows were most numerous on the drier, upper terraces, particularly on the highest terrace where *Calamagrostis nutkaensis* was abundant. A nest containing five eggs was found on June 5. On June 25, the birds were feeding young, most of which had fledged. Some of the adult birds collected at this time were carrying tipulids of large size, and caddisflies (*Lenarchus vastus*). Fully feathered young were collected on June 25 and 26. Savannah Sparrows were also quite numerous in Formation II, especially among the shrubby willows along the east side of the marsh. A nest found here on June 11 contained heavily incubated eggs. Twenty-one specimens were collected. Three were collected in 1888 by C. H. Townsend. The Savannah Sparrows of Middleton Island are a thick-billed form. According to Dr. Herbert Friedmann (personal communication), they would be referable to the southern Alaskan race *crassus*, currently considered a synonym of *anthinus*.

Calcarius lapponicus alascensis. Lapland Longspur. A few pairs of longspurs were observed on the highest terrace, where they were nesting. Two males were collected on June 9; both were in breeding condition, one with testis 12 mm. in length. An adult female was collected on June 26 in a bird-net placed in the willows along the bluff. One pair was seen among driftwood along the beach ridge just west of the largest pond; the birds apparently were nesting.

V. CLIFF TOP.—*Rissa tridactyla pollicaris*. Black-legged Kittiwake. See under Formation VI.

Uria aalge and *Uria lomvia arra*. Common Murre and Thick-billed Murre. See under Formation VI.

Lunda cirrhata. Tufted Puffin. On Middleton Island, the nest burrows of the Tufted Puffin were

Fig. 6. Above: kittiwake nests along top of cliff.
Below: murre eggs among old tussocks of *Calamagrostis* along top of cliff.

most commonly found in the black humus along the top of the cliffs. They were usually excavated where vegetation was sparse or lacking, but some were observed in areas supporting rather large stands of umbellifers. Only a few burrows contained eggs on June 5. An egg examined on June 9 contained a small embryo. These birds were most numerous along the southwest and south ends of the island, but a few were found along the southeast side as well. Tufted Puffins were found infrequently along the cliff sides (Formation VI) since the perpendicular cliffs provided no place for nest burrows. In a few locations, however, the puffins had constructed burrows in masses of soil which had fallen from above onto more sloping cliffs. At the south end of the bluff, where the latter terminated against the cliffs on the southwest side of the island, a long slope was much used by these birds. One Tufted Puffin was collected here in 1888 by C. H. Townsend.

Troglodytes troglodytes. Winter Wren. See under Formation III.

Passerella iliaca sinuosa. Fox Sparrow. See under Formation III.

VI. ROCKY CLIFF.—*Phalacrocorax pelagicus*. Pelagic Cormorant. This was the second most abundant species of cliff-nesting birds. The cormorants were restricted in their nesting distribution mainly to the lower west side and south side of the island, where they occurred in association with kittiwakes and, in one area, with murres. Two subadult birds, conspicuous by their brown color, were observed at the south end of the island. These birds were very shy and were seen only on June 5 and 9. The nests of the cormorants were usually located well up the sides of the cliffs, often just below the top. The nests were frequently placed upon soil in places where erosion of the cliff edges had provided narrow ledges. Most of the nests contained three eggs on June 5, although a few contained four. The first newly-hatched young were seen on June 10. By June 25, nearly all eggs had hatched, but the young birds differed greatly in age. No specimens were collected.

Rissa tridactyla pollicaris. Black-legged Kittiwake. The kittiwake was by far the most abundant bird on the island. All available nesting sites from the top of the cliffs to within a few feet above the high tide line appeared to be occupied. The distribution of the nesting kittiwakes is shown in figure 2. At one location on the west side of the island, kittiwakes were nesting on a slope of relatively loose soil which had been pushed over the bluff by a bulldozer within the last two years. On June 5, the nests contained from one to three eggs, the majority having two. Only about half the nests contained young by June 25. Birds in immature plumage were uncommon; perhaps 10 were seen around the south end of the island. One of these was collected. Near the south end of the island, kittiwakes nested commonly along the top of the cliff (Formation V), where vegetation was sparse or lacking. The total number of nests was not determined, but there were more than 100 nests on level ground (fig. 6). In other places, where the cliff edges had eroded, earth ledges just below the top of the cliff also were utilized. In general, nests in such locations were adjacent to the nests of birds on the cliffs below. Two kittiwakes were collected on Middleton Island in 1888, by C. H. Townsend.

Uria aalge and *Uria lomvia arra*. Common Murre and Thick-billed Murre. Murres were found nesting on the cliff sides in but two localities (fig. 2). They were more numerous on the upper cliff bordering the west side of the island, just south of the junction of this cliff and the bluff. On the east side of the island, about six pairs of murres were seen. The eggs were placed on eroded soil just under the cliff top; they were not seen on rock ledges. Thick-billed Murres were several times more abundant than the Common Murres. The nesting success of the murres appeared to be very low, many of the eggs having been destroyed by gulls. The largest aggregation of murres, numbering about 200, was found at the south end of the island. They were nesting here on the level ground at the top of the cliff. With the exception of a few old tussocks of *Calamagrostis nutkaensis*, the vegetation had apparently been destroyed by the activity of the birds. The eggs had been deposited on rather wet soil around the tussocks (fig. 6). A few eggs examined on June 9 had not yet begun to embryonate.

Lunda cirrhata. Tufted Puffin. See under Formation V.

In addition to the aforementioned birds, two species were nesting in artificial habitats. A few pairs of Bank Swallows (*Riparia riparia*) had burrows in a small gravel pit. Tree Swallows (*Iridoprocne bicolor*) were nesting in cavities in an old building. Both species were observed feeding, particularly over the ponds in the marsh. One Bank Swallow was collected.

TRANSIENT BIRDS

Birds of 25 species were regarded as transients or accidental invaders of the island.

Gavia stellata. Red-throated Loon. One was seen on June 6, swimming in the largest pond.

Branta nigricans. Black Brant. Two were seen on June 11, and again on June 12. Three were present on June 14, and a single bird was seen on June 27. All were on the largest pond. Although quite wary, the birds were observed at length through binoculars.

Aythya marila. Greater Scaup. An adult male was found dead on June 6 along the margin of the largest pond.

Histrionicus histrionicus. Harlequin Duck. An adult male was seen on June 27 a short distance off the north shore.

Melanitta perspicillata. Surf Scoter. A flock of about 20 birds was seen on June 10. It was some distance off the south end of the island.

Mergus sp. Merganser. A female merganser, unidentified as to species, was observed on June 11.

Falco sp. Falcon. A falcon, first thought to be a Gyrfalcon, was seen perched on a rock at the south end of the island on June 5. Its identity could not be established.

Arenaria melanocephala. Black Turnstone. On June 25, three Black Turnstones were observed along the west beach. A female, weighing 123.1 grams, was collected; the largest follicle measured 3 mm., and a brood patch was lacking. Two more birds were seen here on June 27.

Numenius phaeopus hudsonicus. Whimbrel. Two birds were seen along the north beach on June 11 and 13. On June 14, four were present in the same area; a male was collected. The testis measured 5 mm., and the plumage was badly worn. On June 25, a flock of 28 birds was observed in the same area. A female collected at this time had an enlarged oviduct.

Totanus flavipes. Lesser Yellowlegs. Single birds were seen on June 5 and 9.

Limnodromus griseus caurinus. Short-billed Dowitcher. This species was first recorded on June 25, when a flock of eight birds was seen resting on a small hummock in the largest pond. A female was collected on June 25; this bird weighed 104.3 grams and had a brood patch.

Ereunetes pusillus. Semipalmated Sandpiper. Sandpipers of this species were observed on June 25, feeding with Western Sandpipers around the largest pond. A female was collected; the largest follicles measured 2 mm. and the brood patch was refeathering.

Ereunetes mauri. Western Sandpiper. Although absent in early June, Western Sandpipers had become numerous by June 25. Several flocks were observed feeding around the margins of the ponds. Seven specimens were collected on June 25. All were in good condition, with moderate to heavy fat. All had brood patches refeathering.

Phalaropus fulicarius. Red Phalarope. On June 26, a single Red Phalarope was seen feeding with other shorebirds at the margin of the largest pond. It was collected and was found to be a male in breeding plumage. It weighed 44.7 grams, with testis measuring 9 x 3 mm. Molt was beginning.

Stercorarius parasiticus. Parasitic Jaeger. A Parasitic Jaeger was seen on June 10, flying across the island at a moderate altitude. It was collected and found to be a male in melanistic plumage. The testis measured 15 x 7 mm.

Larus glaucescens. Glaucous-winged Gull. The status of the Glaucous-winged Gull was not determined. A few adults were observed around the south end of the island from time to time, but no nests were found. It is possible, however, that they might have nested on a rock pinnacle a short distance off shore. As many as 30 immature birds were seen at one time along the beaches, where they sometimes fed upon dead seals or other material. Three specimens in immature plumage and one adult were collected.

Synthliboramphus antiquum. Ancient Murrelet. A few of these birds were seen off shore during late June. A female was collected on June 27. It weighed 153 grams; the follicles were minute.

Asio flammeus. Short-eared Owl. A Short-eared Owl was seen flying over the higher terraces on June 9. Presumably the same bird was flushed in the marsh on June 10.

Nuttallornis borealis. Olive-sided Flycatcher. One of these flycatchers was seen on June 26, perched on the dead branch of a willow at the foot of the bluff. It was collected and found to be a male. It weighed 38.8 grams, and the testis measured 11 x 4 mm.

Eremophila alpestris arcticola. Horned Lark. On June 9, a Horned Lark was flushed on the highest terrace. It alighted and was collected. It was a female with follicles measuring up to 2 mm.

Petrochelidon pyrrhonota. Cliff Swallow. A few of these birds were seen feeding over the ponds on June 12. No evidence of nesting was found. With the exception of a short distance along the northeast end, where a beach was lacking, the cliffs around the entire perimeter of the island were examined for nests.

Turdus migratorius. Robin. A single robin, not collected, was seen on June 5, in some low willows at the south end of the island.

Vireo olivaceus. Red-eyed Vireo. On June 26, a Red-eyed Vireo was seen, feeding in typical fashion in the top of a tall willow. It was collected and found to be a female weighing 21.5 grams. It was moderately fat, lacked a brood patch, and had follicles measuring up to 2 mm.

Dendroica townsendi. Townsend's Warbler. On June 11, a male Townsend's Warbler, in breeding plumage, was observed at very close range along the base of the bluff. It could not be collected at the time, and no other was seen.

Wilsonia pusilla pileolata. Wilson's Warbler. A single male weighing 8.2 grams was collected on June 26. The testis measured 3 × 1.5 mm. The plumage was generally worn, and the black cap was very poorly defined.

DISCUSSION

The avian fauna of Middleton Island is comprised of approximately 20 breeding species, most of which occur throughout the Prince William Sound region. Conspicuously absent are those birds associated with the Sitka spruce–hemlock forest which is the major ecologic formation on the islands of the Prince William Sound archipelago and on the adjacent mainland. The species that breed in alpine habitat on the mountainous islands to the north are also lacking. It is evident that the number of species of birds breeding on Middleton Island is limited by the lack of ecological diversity. The small size of the island restricts the occurrence of some species (for instance, the Anatidae), but it appears doubtful that its relatively isolated position has much influence.

The Song Sparrow (*Melospiza melodia*) was unexpectedly absent from Middleton Island. This bird is widely distributed in the Prince William Sound region where, as is characteristic farther to the west, it breeds commonly in the plant communities of the seashore (especially in *Elymus*). It would seem that its habitat requirements are fulfilled on Middleton Island, and its absence is difficult to explain. It seems possible that a small, resident population of Song Sparrows, if restricted essentially to the beach ridge formation, might have been adversely affected by the depredations of foxes during the years in which fur farming was practiced here.

The Lapland Longspur is a bird of the tundra biome. In the approximate latitude of Middleton Island, it has not been known previously to breed east of the Alaska Peninsula. Although the flora of Middleton Island probably has been derived from the islands and mainland to the north (Thomas, 1957), the vegetation of the upper terraces has a tundra–like appearance. From the standpoint of vegetational form, Middleton Island resembles islands in the lower Alaska Peninsula–Aleutian region more than it does those of the Prince William Sound archipelago. In the case of the Lapland Longspur, the form of the vegetation may be much more important than its qualitative composition.

The cliff-nesting birds of Middleton Island showed unusual behavior in connection with their nesting. Although it was not practicable to make an accurate count, it was estimated that the kittiwakes numbered several thousands. It was evident that all available nesting sites were occupied. According to Coulson and White (1956), the older birds probably return to the nesting sites of the previous year, and they also begin to nest earlier than do the young birds. In colonies which have nearly attained the maximum size permitted by the available habitat, the younger birds are forced to utilize nest sites that are marginal. On Middleton Island, it was observed that the late–nesting kittiwakes occupied the sites near the bottom of the cliffs, many of which were only a few feet above the high tide line. When Dr. John Thomas revisited the island in August, 1956, these nests alone contained relatively small young.

Along the top of the cliffs, the kittiwakes did not nest appreciably later than those along the upper cliff sides. The earliest hatching of young occurred in the latter situation, but there was a broad overlap between the two nesting groups. From this, it might be concluded that the level ground along the top of the cliff is relatively acceptable habitat, and it is utilized to a large extent by the older, early-nesting birds.

The nests along the cliff top were identical in construction with those on the cliff sides, and they were similarly spaced. In general, they represented an extension of the nesting colony from below. Similar nesting of kittiwakes has been reported by Paludan (1955); in this case the nests were located on boulders, piles of debris, and other material on a low, flat island.

The nesting of the kittiwakes on level ground may not be unusual behavior despite its infrequent occurrence. Such nesting can be successful only in the absence of terrestrial predators, of which the arctic fox is foremost in importance. The breeding range of the kittiwake corresponds to the range of the arctic fox throughout the holarctic region. On islands such as St. Lawrence and St. Matthew, in the Bering Sea, the writer has observed that kittiwakes typically place their nests on ledges quite inaccessible to foxes, which have great ability to climb such cliffs in search of birds and nests (Braestrup, 1941). It is true that the cliff nesting takes precedence over ground nesting, but factors other than the simple selection of sites may be involved. It is possible that ground nesting is usually begun as a gradual process in the presence of an established cliff–nesting colony, and that the birds do not directly colonize habitats that favor ground nesting alone. The adaptation to cliff nesting in the kittiwake has been discussed by Cullen (1957).

Murres were observed in but three widely separated localities (fig. 2); there were about 400 birds in the aggregate. The largest colony, of just over 200 birds, was nesting on level ground along the top of the cliff (fig. 6). The number of eggs here indicated that about 50 pairs were nesting. The restriction of the murres to so few colonies might indicate unsuccessful competition with the kittiwakes. Such competition could be direct, but the kittiwakes appeared to be earlier nesters and probably excluded the murres by occupying most of the nesting sites. Since murres usually nest high on cliffs, they seem to be less adaptable than the gulls in the selection of nesting sites. The absence of predators in this case would appear to make ground nesting at least moderately successful. It was noted, however, that a large proportion of the eggs of murres on the cliff top was destroyed, evidently by Glaucous-winged Gulls. Long term observations would be necessary to make possible an understanding of the relationships involved between the murres and the kittiwakes.

The transient birds observed on Middleton Island fall into two categories: (1) those species of obviously casual occurrence, often recorded on the basis of a single individual, and (2) the nonbreeding shorebirds, which occurred in flocks during the last half of June. Among the latter, the Western Sandpiper and the Whimbrel were particularly conspicuous, but also present in some numbers were the Short-billed Dowitcher, the Black Turnstone, and the Semipalmated Sandpiper. The birds representing the latter group were in breeding plumage, and in some the gonads were regressing. These birds apparently had reached their breeding grounds, attained breeding condition, but had been unsuccessful in nesting. It was not possible to determine how long these birds remained on Middleton Island, but Dr. Thomas observed flocks of Whimbrels in early August, and shorebirds of smaller species were abundant. It appears that such birds may pass the earlier part of the summer in favorable habitat, such as Middleton Island, and eventually migrate with the birds which have nested successfully. Marshall (1952) studied nonbreeding in arctic birds on Jan Mayen Island, but he was concerned only with those birds which remained on the nesting grounds. There appears to be little information on the early migration of such arctic birds which have failed to nest.

Little is known of the birds found on Middleton Island during migration. In May, 1788, it was noted that ". . . geese and other species of water–fowl flock there in great numbers . . ." (Coxe, 1803). The island would seem to be especially well situated in relation to migration routes across the Gulf of Alaska, and, with its tundra–like character, it might well attract arctic species which would avoid the islands to the north. The invasion of Snowy Owls during the fall of 1957 is of interest in this connection, since none was reported in the Prince William Sound region or elsewhere in the timbered

regions of southern Alaska during this time. Middleton Island would seem to afford a location where further ornithological studies might be rewarding.

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SUMMARY

A survey of the birds of Middleton Island was made by the writer in June, 1956. Forty–five species of birds were recorded. Of these, at least 16 species were breeding, four other species were possibly breeding, and 25 species were regarded as transients. The distribution of the breeding birds was correlated with six major ecological formations. Five of the latter were based on vegetational characteristics, while the rocky cliffs comprised the sixth.

The avian fauna of Middleton Island consists mainly of species found in the Prince William Sound region, to the north. An important exception was the Lapland Longspur, which previously has not been known to breed east of the Alaska Peninsula at the latitude of Middleton Island. Both murres and kittiwakes were found to be nesting on level ground along the top of the cliffs. Flocks of nonbreeding shorebirds were observed. These and other findings have been discussed.

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OBSERVATIONS ON THE NIGHTINGALE WREN IN COSTA RICA

By PAUL SLUD

The Nightingale Wren (*Microcerculus marginatus*) is "famous both for its rarity in collections and the complicated series of plumages which have served as the basis of numerous supposed species" (Griscom, 1932*a*:360). The living bird is equally famous for its song, which has been highly commended by the few ornithologists who have heard it. Since there are few published references on the voice or habits of this bird, it seems desirable to present some of my observations made from 1950 to 1955 in the course of a general survey of the birds of Costa Rica.

DISTRIBUTION AND HABITAT

In Costa Rica, the Nightingale Wren lives throughout much of the country, almost exclusively in tall, virgin forest. Carriker (1910:754) gives its altitudinal range as extending from about 1500 feet to at least 7000 feet. I have seen the bird from a few feet above sea level up to nearly 6000 feet. The distribution of the bird's centers of abundance shows no particular correlation with the vertical zonation of climates. Thus, in southwest Costa Rica I found it common at upper tropical and subtropical elevations in the Térraba-El General region and at the foot of Mount Chirripó, and occasionally I noted its presence farther south in the lower tropical zone in the neighborhood of Piedras Blancas. On the Caribbean side of the country it is common low in the tropical zone in the extreme southeast, in the Talamanca-Sixaola region; to the north and west, the bird seems to be distributed locally in smaller numbers at various altitudes. In the northern half of the Pacific side of Costa Rica, it is absent from the relatively arid tropical lowlands, but it is a common resident above 2000 feet, along the wet, forested slopes of the continental divide where I even found it close to the summit of Miravalles Volcano. Depending upon the nature of the terrain, in many areas it seems to be restricted to steep slopes, ridges, and ravines, but in other places it may occur in comparatively level tracts (fig. 1).

It should not be inferred from the foregoing that this wren is one of the more common birds of Costa Rica. On the contrary, "common" is a relative term which I have applied to the bird's status in certain selected localities wherever one or more of several scattered individuals gives evidence of its presence at least once daily. In the El General region, for example, it is relatively so "common" that it may spread to the forest edge or beyond it into thickets and wild, scrubby growth. Nevertheless, the bird is rarely seen, and if it were not for its voice, it would escape detection almost completely.

A solitary bird, the Nightingale Wren dwells in brushy or leafy ground cover, where it often perches just above the forest floor. It is small in size (slightly over 4 inches), dark brown in color, with a diminutive, upturned tail and a rather long, slender, straight bill; even when seen it can be difficult to identify. It looks most like a small antbird of the semi-terrestrial type, particularly because of the stubby tail and, at close range, the bare bluish skin around the eye. This wren also resembles a small rail because of the tiny tail, long bill, and long legs. The dull coloration, although somewhat different from that of similarly plumaged birds, is of little comparative value in the obscurity of the forest understory.

This wren is difficult to find in spite of the fact that the call note betrays the bird's slow, steady progress through the undergrowth. It is most often met with accidentally, and the encounters are usually infrequent. An individual may halt its swift flight across a trail to perch sideways upon a stem before disappearing, or one might perhaps be glimpsed creeping into view upon a low limb or fallen trunk, or by chance it might be

spied upon the ground beside a pile of brush. This very peculiar wren, however, has the habit, when it walks, of teetering like a Spotted Sandpiper (*Actitis macularia*). Cherrie (1893:70) noted this mannerism and made the same comparison. If the observer will remember that the only other teetering birds in the Costa Rican forests are the Buff-rumped Warbler (*Basileuterus fulvicauda*) and an occasional migrant water-thrush (*Seiurus motacilla* and *S. noveboracensis*) or Ovenbird (*Seiurus aurocapillus*), he will be able to identify this wren more readily.

VOICE

To some people in Costa Rica, especially in the northern half of the country, the bird is known, at least by reputation, as the "pito real." A small number of people have heard the song; even fewer persons can correctly associate the song with the bird producing it. Rarely, I have met someone who has been able to describe this wren as being very small in size, brown in color, nearly tailless, and ground dwelling.

Because of its name, one would expect that the Nightingale Wren is an accomplished singer. As attested to by Salvin (1861, 1866), Salvin and Godman (1880), and others, including myself, its voice is indeed remarkable. Identifying the sounds with the bird, however, is another matter. In my own case, I had to eliminate other species from consideration before suspecting that I had heard the Nightingale Wren. A longer period

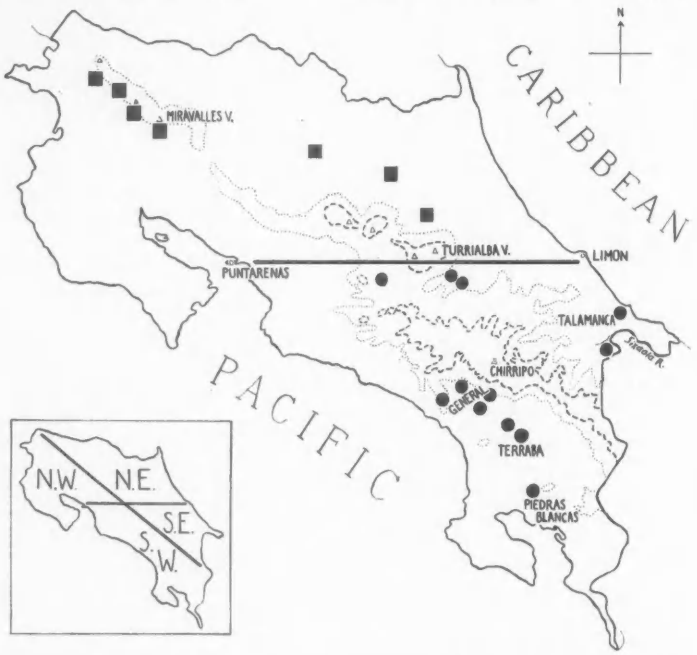

Fig. 1. Map of Costa Rica showing localities where the Nightingale Wren (*Microcerculus marginatus*) was found. Dashed lines = 2000 meter contour; dotted lines = 1000 meter contour. Song types of Nightingale Wren are marked as follows: solid squares = "pito real" song; solid circles = the other song. Inset shows orientation in Costa Rica.

of time passed before I actually saw a bird singing. To complicate matters, this wren gives two songs which are completely different from one another. Thus, more time passed before I discovered that the second song also belonged to the Nightingale Wren.

Griscom's (1932*b*:299) statement that the bird has a marvelous song in the breeding season might imply that individuals sing only at that season. Unfortunately, this author does not tell us in which season the bird breeds. My records show that this wren sings throughout most of the year. I heard one of the songs in February, March, April, May, August, September, and November; the other song was heard in January, February, April, June, July, August, and the last week of October. I have no records for the missing months; at those times I simply did not happen to visit places where the birds occur.

The following "pito real" song is the one which Costa Ricans esteem and it is almost certainly the same as the song of Salvin and Godman's (1880:77) "ruiseñor" in Guatemala. The song is difficult to describe in other than generalized terms because it consists of individual, consecutively given whistles running into a pattern which rambles up and down the scale. If diagrammed, the song would look like a jagged graph. It starts with several high-pitched notes succeeding one another rapidly in ascending order, and then it slackens and trends irregularly downward and upward; suddenly it accelerates and rises in pitch until, having achieved a high point, it again sinks and fluctuates in random fashion, whereupon with renewed energy it mounts once more to a high, thin note of the musical scale. The high and low notes vary in the leisurely course of the long-continued, haphazardly sustained utterance. The penetrating quality of the notes is incisive rather than mellow, and the song as a whole, in my opinion, lacks sweetness. Although pleasing in a musical sense, it is not especially melodious. It is outstanding because of the striking, fitful variations in pitch, and the continually revived outpourings help make it totally unlike the song of any other Costa Rican bird. At a little distance, the high-pitched, rapidly rising sequences may not be heard but, even so, the rest of the song is instantly recognizable.

The other song is absolutely unique. It starts with three to eight rapid, thin whistles which, rising consecutively up the scale, are similar to those in the introduction to the song just described and in quality and pattern might be taken for a similar sequence given by the Cinnamon Becard (*Pachyramphus cinnamomeus*). The last of these thin whistles, however, is prolonged. It marks the close of the prologue and serves as the keynote for what follows. After a pause, the keynote is succeeded by another long, keen whistle that is slightly lower in pitch. A somewhat longer pause is followed by another sweet but "joyless" whistle which is fractionally lower in pitch, and so on. Each minor whistle, beginning with a lisp from which it emerges with a trace of an off-key quaver, follows the preceding one like a pensive afterthought. After the sixth or eighth whistle, the gradually lengthening intervals of silence may last up to ten seconds. By the time the twelfth or thirteenth whistle has been given, the fascinated listener has given up trying to predict whether the ensuing pause will eventually be broken by still another note, all the while wondering how much further the subtly altering pitch might succeed in its delicate descent. The song goes on, usually, for some thirty or forty notes over a period of several minutes. The listener is never sure when it has definitely reached its end. This simple song is the most remarkable one I know, but oddly enough few people whom I met in Costa Rica knew of this performance. Not many persons whose attention I directed to this song were visibly impressed by it. The song may sometimes be given in a slightly varied manner. With some individuals the pauses do not keep lengthening after the first several notes; with others, the notes may be doubled.

Wherever the Nightingale Wren occurs in the country, it may, or may not, give

voice to a single long note, similar to a note in the song just mentioned, at intervals throughout the day. Often this note alone is sufficiently distinctive to indicate the presence of the bird in an area. It rather resembles the whistle of a Broad-winged Hawk (*Buteo platypterus*) when weakened by distance. The bird also gives a wren-like or antbird-like chatter, and a strong *stchep* (or *stchip* or *tseck*).

SONG AND TAXONOMY

A map, on which I have plotted the localities at which I heard either of the two songs, discloses a pattern of distribution that is as remarkable as the songs themselves (see fig. 1). This map shows that the "pito real" song was heard only in the northern half of Costa Rica, and that the other song was heard only in the southern half of the country. I have tentatively drawn the dividing line between the two zones as extending almost precisely along latitude 10°N, from Puerto Limón on the east coast to Puntarenas on the west coast. I know of no other bird in Costa Rica with such a pattern of variation. It violates all biogeographical boundaries.

I was first struck by this anomaly when I heard one song at the northern base of Turrialba Volcano and then heard the other song a little to the southeast of the same volcano. I could segregate other singing records likewise according to type. Although all records may each possess an equal value, it should be pointed out that these records were obtained in greater number in some localities than in others. In the northwest, southwest, and extreme southeast, I heard many birds over a large district; on the north side of Turrialba Volcano there seemed to be no more than one or two birds which I heard many times in a limited area. Elsewhere I heard only one bird singing once or, at most, two or three times. Nevertheless, the fact remains that not a single bird sang the "wrong" way. Each song represented a datum contributing to the establishment of this perplexing zonation.

Taxonomically, Ridgway (1904:667–670) believed that there were three nearly similar species of nightingale wrens in Central America: one in Guatemala, another in eastern Costa Rica, and a third from southwestern Costa Rica to the Isthmus of Panamá. Later, Bangs (1909:34–35), Hellmayr (1934:282–283), and Griscom (1932*a*:360–365) independently arrived at the conclusion that Ridgway's three species should be combined in a single subspecies. Griscom's investigation was particularly thorough. He examined no less than seventy-six specimens which were equally divided in number between Central American and South American forms. A study of "the exceptional material at [his] command" caused him to unite all the birds north of (and including) the Canal Zone into the subspecies *philomela* which he considered a race of the South American *Microcerculus marginatus*.

Neither Ridgway's treatment nor the treatments by Bangs, Hellmayr, and Griscom are in accord with the situation in Costa Rica as I have mapped it. The disagreement is caused by the conflict between an interpretation based on morphological grounds on the one hand, and geographic distribution based on song on the other hand. The fundamental question is: do differences or similarities in voice between closely related birds have taxonomic validity? In my opinion, this question must be answered in the affirmative with the qualification that the relative validity may differ from group to group.

If, with respect to song in the Nightingale Wren, the assumption is provisionally made that it does have some taxonomic value, a strange predicament results. As a consequence of this premise, the birds fall into neither specific nor subspecific categories, nor can they be regarded as subpopulations of a single race, as I shall attempt to show.

If two species of nightingale wrens should occur in Costa Rica, as Ridgway (1904) believed, then their geographical distribution fails to match the distribution of song

types. In order to conform to the latter, the birds of Caribbean Costa Rica (including those living along the continental divide in the northwest) must be split into a northern and a southern group, and this southern Caribbean group must be combined with the southwestern, Pacific group (fig. 1). If song is assigned the weight of a specific character, then Ridgway's assemblage of morphological specific characters breaks down when applied to either of the two groups segregated on the basis of song type. If the two song groups exhibited even the slightest constancy of morphologic characters in association with the differences in voice, they could conceivably be considered full species. In short, Ridgway's species, as redefined and reapportioned geographically on the basis of song, can no longer be characterized as species on morphological grounds.

Should song now be assigned the weight of a subspecific character, it can be used to test the view expressed by Bangs, Hellmayr, and Griscom. If there is in Costa Rica only one subspecies of Nightingale Wren, then this population must be considered as varying morphologically within narrow limits, since these systematists were unable to find consistent morphological characters by which to further subdivide the group. The dilemma is that the birds can be split into two contiguous geographic populations on the basis of song, thus implying the existence of two discrete groups, but these two groups cannot be differentiated by the museum taxonomist. In Costa Rica, there are definite instances of geographically separated races of other birds having dissimilar or completely different songs or calls consonant with the geographic ranges, but these races are characterized by morphological differences. On the basis of song, the taxonomic situation in the Nightingale Wren seems to be matched by no comparable one in the subspecific category.

As a final recourse, let the taxonomic weight of song be reduced still further to a position below the subspecific level. Local variations in bird songs do exist, and it is possible that one of these variations, at least when correlated with the limits of a geographically isolated group, may have a genetic basis, thus indicating a local population difference within the bounds of a morphologically defined subspecies. On the other hand, the song differences among the isolated groups making up a race may often be neither geographically correlated nor genetic but be due rather to imitative learning. However, unlike the song populations of other species of birds, those of the Nightingale Wrens of Costa Rica do not alternate geographically, nor are they randomly dispersed behind barriers so that an isolated group with one song type occurs within the range of birds with another song type. In addition, they do not present a situation in which a very small, local population occurs at the periphery of the range of a larger, more extensively distributed population. The division of the range in Costa Rica into a northern and a southern half is not duplicated for any other species in the bird fauna of that country. The distribution of song types affords no evidence of local population differences within either group.

From the preceding analysis, the conclusion is drawn that the Nightingale Wrens in Costa Rica, if not exactly deprived of a taxonomic status, are left with an indefinite one, and this suggests that in Central America the taxonomy of these wrens has not been definitely worked out. Further work is needed to resolve this problem. Fortunately, the living birds, by voice alone, offer in the field qualitative symbols capable of conversion into a quantitative pattern of distribution. Observations made at the southern limit of the range of *philomela* should be forthcoming from Barro Colorado Island in the Canal Zone, where many naturalists visit and where the bird has been known to occur and to sing (Eisenmann, 1952:1, 47). Information from the northern end of the range in Chiapas might be supplied by Paynter (1957*a*:270), who notes that this wren "was by no means rare" and that "its call is distinctive and was heard about once a day while collecting in the broadleaf forest."

If the wrens in a particular region should be determined as singing in the same manner, every specimen collected ought to have the song type marked on the label. As these specimens accumulate, a critical museum examination might yet manage to elaborate more detailed morphological criteria. A morphological recognition of two populations, in turn, could lead to a reappraisal of *philomela* and perhaps to a re-evaluation of the limits and contents of allied races.

DISCUSSION

The critical division between the song groups of the Nightingale Wren is, admittedly, distributionally irrational. Instead of coinciding with ecological barriers, it cuts across them. One might reasonably suspect that the birds were once separated and that their ranges adjoined later. The original separation could have been brought about, for example, "during the Cenozoic when Middle America was divided by various seaways," a possibility postulated by Paynter for his "*Troglodytes solstitialis* complex" (1957*b*: 13–14). If unqualified, this postulate ignores the element of time. A portal separating northern Central America from southern Central America existed from the early Paleocene to at least the mid-Pliocene (Simpson, 1950:365). Therefore, even if it be conceded that these ancient wrens had already attained the status of a recognizable entity in the Paleocene, until the reappearance of a land connection there intervened a temporal gap during which there was ample time for the groups to have evolved into unequivocally distinct, perhaps supraspecific, taxa. It is inconceivable that two populations should have maintained a similar morphology after having lived in isolation from one another for approximately 50 million years.

This difficulty can be overcome only if one resorts to the possibility of island hopping. This provides a means whereby the individuals of an ancestral stock might have crossed the water barriers considerably later in the Tertiary. That it must have served as the distributing agent even for some members of certain groups of land mammals cannot well be disputed. Yet the forest habitat and habits of Nightingale Wrens strongly suggest dispersal along ecologically suitable corridors rather than by the accident of rafting or by the birds' impulsive vagaries to set out in flight over open ocean.

I think it more likely that the present distribution poses a Pleistocene or late Pliocene problem in time. With the re-establishment of a continuous land connection, Nightingale Wrens from South America could have found their way into the Central American isthmus simply by following their habitat in pre-glacial and post-glacial times, and, perhaps by shuttling back and forth, in glacial times. Pleistocene isolation, caused by the effects of glaciation and the island-like disposition of the Central American mountain massifs, would have been relatively recent geologically and would correlate with the relatively small morphological differences among the races or to the morphologically indiscernible difference between the song populations. In detail these arguments, too, suffer the misfortune that the Nightingale Wrens do not seem to have been influenced geographically by what could have been, for other species, important historical factors. Altitudinally, the occurrence of either song type both in the uplands and lowlands invalidates a proposal favoring vertical differentiation. In addition, montane groups which might have been isolated could have been connected, as they are today, by birds occupying the intermediate elevations. Latitudinally, the Nicaraguan "break," separating a northern from a southern population, would seem to be the location of a natural zone of transition. According to my findings, there is no zone of transition but a sharp dividing line which, moreover, lies to the south, where it passes through the lowlands and the central highlands of Costa Rica. An encroachment by northern birds upon the northern

half of Costa Rica, displacing the southern element farther southward, could explain, but rather unsatisfactorily, the position of the dividing line. Or, the extensive volcanic activity of the Pliocene and Pleistocene upon the central plateau of Costa Rica could have created a discontinuity, but the Nightingale Wrens would seem to have been the only birds so affected. The morphological similarity of the birds and the sharpness of the division between the two song populations remain unexplained.

The most important variation in these wrens seems to be in the songs. Starting with them, one can reason forward from, or backward to a time when the groups had become isolated, inconclusively, perhaps, as to the precise period or method of isolation; the finding of fossils would hardly clarify a situation for which singing birds are indispensable. Following the line of thought suggested by differences in voice, one can explore the possibility that song accounts for the present geographic distribution instead of placing emphasis upon the geologic events which might have governed the present distribution of song.

The Nightingale Wrens live in dark forest where they pursue their solitary ways low in the deep gloom of the undergrowth. The dull plumage seems to exhibit no adaptation other than to the surroundings. It is relieved by no bright areas or markings, and the bird flashes no mark, either hidden or exposed. If external morphology should play a passive part in recognition of one another by these wrens, minor variations might be retained, undiscriminated against by natural selection. As a matter of fact, Griscom has commented on the confusing array of taxonomically inconsistent plumages of *philomela* which he labored to fit to individual variation and, serially, to age (1932*a*:360). Hypothetically, on the other hand, a distinctive voice may first have been evolved for the sexual purpose of the birds' finding one another by sound, and perhaps also to deter a bird from intruding on territory already claimed. Next, a dichotomy in song type, resulting in a specialized development in each group, may have arisen after the parent population had become split into two groups. When eventually the ranges met, the different songs (which are apparently given the year round) could have acted as an isolating mechanism to prevent interbreeding. The boundary between the two song populations may represent this behavioral barrier—the chance meeting place to which the spreading front of either group happened to advance from an outlying center of dispersal.

CONCLUDING REMARKS

Perhaps the greatest significance to be attached to my observations is that they were made in the field and are based on behavior. Through one aspect of behavior, namely song, the taxonomic status of a race of the Nightingale Wren, presumed to be genetically uniform because of morphological uniformity, may have been reopened to question. How should other groups of wrens which show slight, or even prominent, morphological differentiation be treated? Most of the family Troglodytidae is notoriously difficult taxonomically at the racial, specific, and even generic levels.

Thus, Paynter (1957*b*:8–12), utilizing the evidence primarily provided by breeding behavior, synonomizes *Troglodytes brunneicollis* with *T. aëdon,* yet "lumps" *T. musculus* and *T. aëdon* despite the absence of such evidence. Further, solely on the basis of a morphological similarity, he has decided that the three groups of his "*Troglodytes solstitialis* complex" are conspecific (*op. cit.*:12–14). However, all three of these allopatric groups show decided behavioral differences. One member of the complex, *T. monticola,* according to Carriker (Todd and Carriker, 1922:418) "is a perfectly distinct, isolated species . . . confined to the Paramo Zone of the Sierra Nevada de Santa Marta . . . at elevations ranging from 11,000 to 15,000 feet, although it has not been detected below the latter altitude by the present writer." The other two members, *T. ochraceus* and *T.*

rufociliatus, I have observed in luxuriant cloud forest in Costa Rica and Honduras respectively. Aside from the birds' unmistakably different appearance, their songs are quite different and their habits, arboreal in one and terrestrial in the other, are extremely different. In addition, Skutch (1940:307–308) has described the remarkable differences in nesting between *ochraceus* in Costa Rica and *rufociliatus* in Guatemala: the nest of *ochraceus* is built "in the decaying segments of branches or among the matted wefts of roots [of air-plants], hanging from the tree by a single stout root and swaying with every passing gust of wind . . . forty or fifty feet above the ground" where "these nests dangling free in the air . . . are inaccessible;" the nest of *rufociliatus* "is an open cup . . . placed in a narrow cranny in a trunk, near the ground, or else in a niche beneath an overhanging bank." Still another example is furnished by *Campylorhynchus yucatanicus,* listed as a subspecies of *C. brunneicapillus* by Hellmayr (1934:150), Blake (1953:399), and Paynter (1955:218), but considered specifically distinct on behavioral as well as on morphological grounds by Zimmerman (1957:57) and R. K. Selander (oral paper presented at A.O.U. meeting, Denver, 1956).

Song is but one of innumerable behavioral characters. Anything the living bird does is behavioral. When sufficiently pronounced, behavioral (and physiological) responses or traits can function effectively as isolating mechanisms when two similar populations meet. The degree of similarity, or of difference, between similar but geographically separated forms must be judged from as many lines of evidence as possible. It seems to be mandatory that the ornithologist have wide field experience, and it is the ornithologist with such background who is almost always conservative in his treatment of troublesome groups. I believe that the situation in the Nightingale Wren, aside from its own unique qualities, reflects the unsettled taxonomy of the Troglodytidae and points to the need for field observations. Song may reveal an unknown element in one instance, courtship displays may confirm a suspicion in another instance. Behavioral evidence can suggest the way to a more natural, systematized scheme of relationships after dead specimens have been exploited to the limits of the taxonomist's ingenuity and intuition.

SUMMARY

Observations on the habits and songs of the Nightingale Wren in Costa Rica are presented. Although only one subspecies of this wren, as defined morphologically, occurs in Costa Rica, two populations seem to be present, each characterized by a very distinctive type of song. The sharp line separating the northern song population from the southern one does not lie along any biogeographical boundary.

It is suggested that past geological factors cannot account adequately for the present distribution of these song populations. The well-defined differences in song may have arisen when the ancestral population was split into two isolated groups. When the isolating barrier disappeared and the two groups came together again, the differences in song may have acted as an isolating mechanism to prevent interbreeding between them. The line dividing the two groups at the present time may merely represent the chance meeting place to which the spreading front of either group happened to advance from an outlying center of dispersal.

Although the Nightingale Wrens of Costa Rica seem to be inseparable morphologically and are referable to a single subspecies on this basis, the presence of two sharply defined song groups in the population of Costa Rica indicates that the taxonomy of the species in that country, and perhaps in all of Central America, cannot be considered as definitely resolved.

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University of Michigan Museum of Zoology, Ann Arbor, Michigan, May 21, 1957.

BIRDS FROM THE MIDDLE PLIOCENE OF McKAY, OREGON

By PIERCE BRODKORB

A collection of avian fossils submitted for identification by Dr. J. Arnold Shotwell provides the first knowledge of the birds of the Middle Pliocene from the Great Basin. Previous information on the Pliocene avifauna of that region is scanty and limited to deposits from the upper and lower portions of the epoch (L. Miller, 1930, 1944; Wetmore, 1933). The material was collected by Dr. and Mrs. Shotwell in tuffaceous sandstone on the east bank of McKay Reservoir, about five miles south of Pendleton, Umatilla County, Oregon. It is preserved in the Museum of Natural History, University of Oregon.

The mammals of the McKay Reservoir local fauna have been described by Shotwell (1955, 1956). This fauna bears a close similarity to that of Hemphill County, Texas, the type locality of the Hemphillian provincial age. The mammals also show affinities to the Middle Pliocene (Plaisancian) faunas of North China and France. The ecological environments are centered about a fresh-water pond, with neighboring grassland and woodland communities.

The fossil birds from the reservoir fit the ecological associations postulated from the study of the mammals, since they include two ducks, a quail, and a sandpiper, the latter possibly a grassland form. As far as identifiable, all genera occur in the present avifauna of Oregon but are represented by extinct species, whereas the Great Basin avian localities of Blancan age (Upper Pliocene) contain a high proportion of living species. The present collection therefore affords additional evidence that living species of birds have a time span extending no farther back than the Upper Pliocene (Brodkorb, 1955).

Comparative osteological material was loaned by the authorities of the United States National Museum, Museum of Vertebrate Zoology, and the University of Kansas Museum of Natural History. Certain measurements were furnished by Dr. Alexander Wetmore and Glen E. Woolfenden. The photographs were taken by Robert D. Weigel.

Family Anatidae

Genus **Nettion** Kaup

Wetmore (1944) has already remarked on a difference between *Nettion* and *Querquedula* in the distal end of the carpometacarpus. In the proximal end of the bone, *Nettion* differs further in having a very shallow carpal fossa, whereas in *Querquedula* the fossa is deeply excavated.

Nettion bunkeri Wetmore

This species was previously known from two carpometacarpi from the Upper Pliocene of Kansas and Arizona (Wetmore, 1944). Four specimens from the McKay Reservoir are referred to this teal, extending its time range to the Middle Pliocene and providing information on additional parts of the skeleton.

Carpometacarpus.—Proximal portions of left (Univ. Oregon no. F–3602) and right (F–4147) carpometacarpi are stouter than in *N. carolinense*. Measurements of the four carpometacarpi now known are given in table 1. The heights through the first metacarpal of the National Museum and University of Kansas specimens were kindly supplied by Alexander Wetmore and Glen E. Woolfenden.

Coracoid.—A left coracoid (F–2675), lacking both ends, is somewhat larger than the corresponding element in *N. carolinense;* least width of shaft is 3.7 mm.

Tibiotarsus.—The proximal portion of a left element (F–4091) agrees with *Nettion* in having the anterior cotyla of the inner articular surface broader than the anterior cotyla of the external articular surface; the reverse condition holds in *Querquedula*. The fossil differs from *N. carolinense* in being larger and in having the inner cotyla deeper, although not as deep as in *Querquedula*. Width of head through articular surfaces is 6.7 mm.

Table 1

Measurements in Millimeters of Carpometacarpus of *Nettion bunkeri*

Specimen	Length	Proximal width	Proximal width of second metacarpal	Height through first metacarpal
U. Kansas 3982 (type)	35.0	4.3	3.6	9.1
U.S.N.M. 10936	.....	4.3	3.7	9.5
U. Oregon F–3602	.....	4.3	3.5	9.3
U. Oregon F–4147	.....	.....	3.5	.....

Nettion bunkeri needs comparison with the earlier named *Nettion eppelsheimense* (Lambrecht, 1933) from the Lower Pliocene of Germany. The latter is described as being more robust than *N. crecca*. *Nettion bunkeri* seems to be slightly larger than *N. eppelsheimense*, as the width of the shaft of the coracoid of that species is given as 3.5 mm.

Anatidae, indeterminate

A left ulna (F–4148), lacking both ends, is indeterminate but resembles the ulna of *Aix sponsa*. It probably represents an undescribed species.

Family Phasianidae

Subfamily Odontophorinae

Genus **Lophortyx** Bonaparte

Excavation on anconal surface of humerus below caput humeri large and extending under internal tuberosity; medial bar at angle of 120 degrees to shaft; ratio between distal and proximal widths of humerus 75.27 to 81.40 per cent; ratio between depth of caput humeri and proximal width of humerus 37.23 to 40.70 per cent; ratio between distance from proximal end of brachialis anticus to distal end of internal condyle and distal width of humerus 75.34 to 81.43 per cent.

Lophortyx shotwelli, new species

Holotype.—Proximal portion of left humerus, University of Oregon Museum of Natural History, no. F–3611, from Middle Pliocene (Hemphillian) of east bank of McKay Reservoir, Oregon. Collected by J. Arnold Shotwell and Genevieve Shotwell, summer, 1950.

Referred material.—Proximal portion of left humerus (F–2553) and distal portions of two left humeri (F–2543 and F–3183). The type is blackish, whereas the three referred specimens are cream-colored, a suggestion that at least three individuals are represented.

Diagnosis.—The humerus agrees in size and proportions with the humeri of the three living species of *Lophortyx*, but differs as follows: caput humeri more rounded and less produced proximally; bicipital crest rounded and not produced distal to ligamental furrow; area between internal condyle and entepicondyle excavated; entepicondylar prominence more distal in position; distal portion of internal margin, between entepicondyle and entepicondylar prominence, nearly straight (concave in living species).

Measurements.—Proximal width of humerus, 9.4 mm.; distal width, 7.1–7.3; depth of head, 3.7; distance from proximal end of brachialis anticus to distal end of internal condyle, 5.5.

The four previously recognized fossil species of Odontophorinae include *Colinus hibbardi* Wetmore (1944) from the Upper Pliocene of Kansas, *Cyrtonyx cooki* Wetmore (1934) from the Upper Miocene of Nebraska, *Cyrtonyx tedfordi* L. Miller (1952) from the Upper Miocene of California, and *Miortyx teres* A. H. Miller (1944) from the Lower Miocene of South Dakota. The new species is smaller than any of these quail; it also differs in generic characters.

Family Scolopacidae

Genus **Bartramia** Lesson

Carpometacarpus with distal ends of second and third metacarpals fused for distance about equal to length of condyles; distal end of third metacarpal curved and decidedly shorter than second metacarpal; posterior margin of third metacarpal slightly concave before its fusion with second metacarpal;

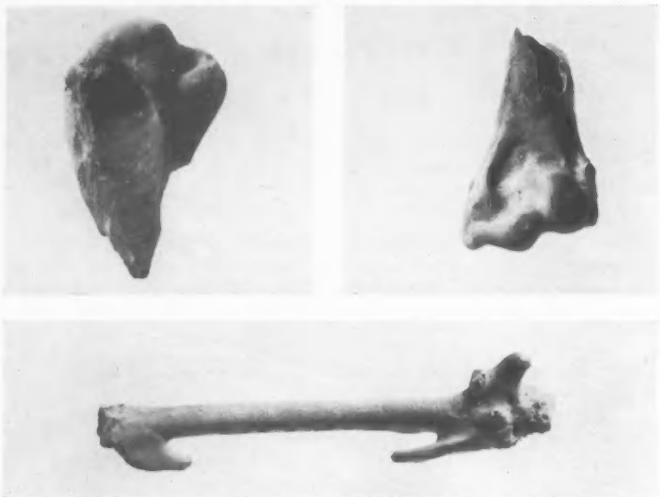

Fig. 1. Upper left, *Lophortyx shotwelli,* holotype, no. F–3611; upper right, *Lophortyx shotwelli,* referred specimen, no. F–3183; lower, *Bartramia umatilla,* holotype, no. F–3727. All specimens three times natural size.

a slight but distinct intermetacarpal tuberosity near proximal end of intermetacarpal space; shaft of second metacarpal gently curved to meet first metacarpal, the projected curve extending along anterior face of first metacarpal; pollical facet and proximal edge of first metacarpal at an angle of about 60 degrees to shaft of second metacarpal; anterior edge of first metacarpal at an angle of about 45 degrees to shaft of second metacarpal.

Bartramia umatilla, new species

Holotype.—Right carpometacarpus, University of Oregon Museum of Natural History, no. F–3727, from Middle Pliocene (Hemphillian) of east bank of McKay Reservoir, Oregon. Collected by J. Arnold Shotwell and Genevieve Shotwell, summer, 1950.

Diagnosis.—The carpometacarpus is much smaller than that of Recent *Bartramia longicauda,* being but slightly larger than in *Lymnocryptes minimus*; pollical facet with tuberosities reduced; process of first metacarpal with edges rounded rather than angular.

Measurements.—Length, 23.5 mm.; proximal width, 2.4; distal width, 2.4.

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Department of Biology, University of Florida, Gainesville, Florida, December 11, 1957.

FROM FIELD AND STUDY

Use of Nest Boxes by Wood Ducks in the San Joaquin Valley, California.—Although the Wood Duck (*Aix sponsa*) is rather common locally in California, its ecology has not been well studied. In 1953 and 1954 the writer, in cooperation with the California Department of Fish and Game, studied the production of Wood Ducks in nest boxes in the San Joaquin Valley. This report summarizes observations made in those two breeding seasons. This work was financed in part by funds from Pitman–Robertson Project 30R under the direction of Game Biologist Wendell Miller.

The breeding range of the Wood Duck is limited primarily to the deciduous forest areas of the United States. The vast majority of the birds is found in the eastern half of the country. The relatively small breeding population inhabiting the west coast occurs in British Columbia, Washington, Oregon, and California. These ducks winter primarily in the latter two states. In California the breeding metropolis is in the Sierra Nevada foothills of the Central Valley, as far south as the Kings River. During the fall and winter months Wood Ducks congregate in the valley and are commonly found in flocks as far south as Bakersfield. The San Joaquin Valley is the southernmost extension of the western breeding range.

From personal observations and talks with residents, the seemingly most desirable local areas for nesting Wood Ducks were selected for study. The foothill sections of the Merced, San Joaquin, and Kings rivers were so chosen and several hundred hours were spent traversing them on foot and by automobile.

The Wood Duck normally nests in hollow trees or suitable substitutes, over or near water. Since the growth of such trees is rather sharply restricted in the San Joaquin Valley, and since trees are being removed at an increasing rate along river bottomlands to make way for agricultural expansion, this study was designed to measure the availability of natural nest sites and the possibilities of augmenting these with artificial nest boxes. With these objectives in mind, certain areas were carefully and systematically searched for natural nests. None was found. Since many adults and some broods were observed, nesting must have taken place undetected.

In order to have a better understanding of productivity, 39 nest boxes, of the type recommended by the Illinois Natural History Survey, were installed as follows: Merced River, 19; San Joaquin River, 3; Kings River, 6; Roeding Park in Fresno, 6; Los Banos Refuge, 3; and lower San Joaquin River near Gustine, 2.

The boxes were placed in a variety of locations. The successful nests, without exception, were in wooded areas, over or in close proximity to open water, and they were plainly visible from the waterway. None of the boxes placed in marshy areas, or along vegetation–choked streams or sloughs, was selected for use by the ducks.

The nesting period was observed to extend from the last week of March to the first of August, a longer period than has been noted by eastern investigators. Attempts at renesting may have accounted for the late records. In the nests studied, Wood Ducks laid one egg per day until the clutch was complete. The 51 eggs measured were considerably smaller than those recorded by others, averaging 46.8 mm. in length and 37.4 mm. in width. Length ranged from 43.5 to 52.4 mm., and width ranged from 34.1 to 39.4 mm. The averages given by Bent (Bull. U. S. Nat. Mus., No. 126, 1923: 162) for 99 eggs were: length, 51.1 mm., and width, 38.8 mm. Dixon (Condor, 26, 1924:56) found that 26 eggs laid by Wood Ducks in California averaged 52.4 x 39.0 mm. Incubation lasted approximately one month, although in one case in which six eggs failed to hatch, it continued for at least 72 days.

Wood Duck productivity, as determined through the use of nest boxes in the study areas, is indicated in table 1. It can be seen that there were 14 nestings in the 39 boxes for the year 1954. The clutches averaged 13.6 eggs of which 65.8 per cent hatched, with 4.8 per cent of the ducklings dying in the nests. These figures have been divided into two groups to show the distinct differences in success in "normal" and "dump" nestings (those containing eggs from several hens). The normal nests averaged 8.5 eggs per clutch of which 82.6 per cent hatched, while the dump nests averaged 20.2 eggs per clutch of which 55.9 per cent hatched. This discrepancy can be attributed to three factors: first, the time interval from the laying of the first egg to the onset of incubation in the dump nests may have been so great that the first eggs failed to develop; second, with a large clutch the hen may not have been able to cover and turn all the eggs in such a way as to maintain viability; and third,

Table 1

Wood Duck Productivity in Nest Boxes in the San Joaquin Valley, 1954

	Eggs	Hatched and left nest	Eggs left	Dead young in nest	Destroyed
Normal Nests					
	7	6	1		
	12	12			
	1				1
	8[1]				8
	6	6			
	10	10			
	8	8			
	9	8	1		
	8	5	2	1	
Totals:	69	55	4	1	9
Dump Nests					
	24	7	15	2	
	20	18	1	1	
	19	6	11	2	
	18	14	4		
	23	8	15		
	17	11	6		
Totals:	121	64	52	5	0

[1] Nest observed in 1953.

eggs dumped in the nest after the start of incubation, during the absence of the incubating hen, would have contained underdeveloped embryos at hatching time. The frequency of dump nesting, along with the observed use of brushy squirrel nests and buildings, is convincing evidence of the critical lack of nest sites in certain local areas.

Nest boxes provided for Wood Ducks are used by other animals as well. In some cases this usage may be such that the boxes become unavailable for use by the ducks. Some of the competing species, such as the raccoon, are known predators of Wood Duck nests. Even though there was an unexpectedly low incidence of predation in this study, the boxes were used almost as frequently by other species as by the Wood Duck.

The findings of this preliminary study suggest that nest sites for Wood Ducks are indeed in short supply in the San Joaquin Valley and that increased productivity might be stimulated by adding additional nest boxes, which would give more pairs places to nest and increase production in occupied nests by reducing dump nesting.—Richard H. Robinson, *Monterey Peninsula College, Monterey, California, December 31, 1957.*

An Osprey in Mideastern Pacific Ocean.—At 6 p.m. on October 6, 1957, coast guardsmen aboard the Coast Guard cutter *Pontchartrain* observed a large hawk-like bird circling the ship. The *Pontchartrain* on this date was occupying ocean station "November" (lat. 30°N, long. 140°W), which is the aeronavigational point of no return between the California coast and the Hawaiian Islands. The nearest landfall (Hawaii) from ocean station "November" is 1161 nautical miles. Coast guardsman Lambert D. Greenlee states that the bird, which subsequently was identified as an Osprey (*Pandion haliaetus carolinensis*), continued to circle the cutter for the next five hours, during which time it made twenty-five landings on the masts, radar antennae, and weather bridge, and on one occasion even startled a lookout on watch by attempting to land on his head. The bird was observed to be in an extreme state of exhaustion, as it would droop its head low each time it perched aboard the cutter. During the course of the bird's twenty-five perchings, Mr. Greenlee made repeated attempts to capture

it. At 11 p.m. the bird was finally snared by Mr. Greenlee and, because of its exhausted state, it made only feeble attempts to escape.

A cage was prepared and the bird was offered water, frozen fish, chicken, and egg. During the following ten days, it was seen to drink water and eat a small amount of chicken and egg yolk but appeared to lack the strength to feed properly. On October 16, 1957, the *Pontchartrain* docked at Long Beach, California, and Mr. Greenlee immediately contacted the Los Angeles Museum. The bird was dead, however, upon my arrival aboard the cutter the following morning. Examination of the specimen showed that it was a subadult female in good condition except for the fact that it was extremely emaciated (weight 1027.6 gms.) because of its long flight and subsequent period of fasting aboard the ship.

It is of interest to note that at the time the bird arrived aboard the cutter, a strong southwesterly wind of 25 knots was blowing and there was a moderately heavy sea. Barometric readings taken from the log of the *Pontchartrain* ranged from 29.91 to 29.95 during the time the bird was circling the ship.

It is possible that the origin of the bird was one of the islands of the Hawaiian group, as the species is known to be of accidental occurrence in those islands. The specimen (LACM 28740) is definitely assignable to the race *Pandion haliaetus carolinensis* rather than to *P. h. haliaetus* of the western Pacific.—Kenneth E. Stager, *Los Angeles County Museum, Los Angeles, California, December 11, 1957.*

Pomarine Jaeger from the Interior of Texas.—The Pomarine Jaeger (*Stercorarius pomarinus*) is rarely reported from areas away from the ocean. According to L. R. Wolfe (Check-list of the Birds of Texas, Intelligencer Printing Co., Lancaster, Pa., undated), the species is known in Texas from but a single specimen taken at Matagorda Island, on the Gulf coast, and from several unverified sight records. The capture of a Pomarine Jaeger at Lake Kickapoo, Archer County, Texas, by State Game Warden Morris Stallcup and the writer, on October 8, 1957, is therefore doubly interesting. It apparently constitutes the second verified record for the state and it is from a locality almost 400 miles from the coast.—Walter W. Dalquest, *Midwestern University, Wichita Falls, Texas, January 20, 1958.*

The Odor of the Crested Auklet.—On June 14, 1952, at Hooper Bay, Alaska, Eskimos brought Humphrey four Crested Auklets (*Aethia cristatella*). These birds had been found in weakened condition on small, fresh-water ponds among the dunes along the Bering Sea coast, and they were captured by the Eskimos because of their novelty. The weather prior to June 13 had been overcast with intermittent rain and strong winds of 30 to 40 miles per hour from the southwest. The wind shifted to the west on June 13 and died down on the fourteenth when the sky cleared and the temperature rose to 50 degrees. It seems probable that these birds had been blown out of their normal breeding range by the strong winds.

One of the auklets was a male, one was a female, and two were of undetermined sex. In handling the birds, Humphrey noticed a pungent odor reminiscent of the smell of tangerines. Close examination revealed that the odor emanated from the region of the bill and was present in each of the four specimens. The bills and bill ornaments of these birds were bright scarlet orange. According to Ridgway (The Birds of North and Middle America, Bull. U. S. Nat. Mus., No. 50, Part 8, 1919:775), Crested Auklets during the breeding season have the "bill, including supra-rictal plate, orange-red or reddish orange, the tip more or less whitish or pale horn color . . . ." After the breeding season, Crested Auklets assume a "winter" plumage in which the bill is "smaller (through shedding of supra-nasal cuirass, supra-rictal plate, and other parts) and dull brownish or horn color instead of reddish orange." As far as could be determined, the tangerine-like odor of these birds stemmed only from the bill ornaments. Museum specimens have no trace of this odor, although the bill and bill ornaments retain their scarlet orange coloration with little loss of brilliance. The tangerine-like odor emanating from the bill ornaments is characteristic of both sexes and presumably is lost along with the bill ornaments after the breeding season. More observations are needed to determine the relationship of this odor to the molt of the bill ornaments and to the reproductive cycle of the Crested Auklet.

On July 10, 1954, Phillips collected two breeding adult Crested Auklets from the nesting cliffs southeast of the village of St. Paul, St. Paul Island, Alaska. On retrieving the specimens, he noticed

that they had a pleasant odor strongly reminiscent of that of citrus fruits and comparable in strength to a freshly peeled orange. Later in July, Phillips was riding in a small boat on the Bering Sea when he suddenly became aware of this same pungent odor. He looked for the source of the odor and finally saw a flock of about 200 Crested Auklets rise from the water a hundred yards or less ahead of the boat and fly off. With the departure of the birds the odor disappeared.

Humphrey's observations were made while aided by a contract between the Office of Naval Research, Department of the Navy, and the Arctic Institute of North America; reproduction in whole or in part is permitted for any purpose of the United States Government.—PHILIP S. HUMPHREY, *Peabody Museum of Natural History, Yale University, New Haven, Connecticut,* and RICHARD E. PHILLIPS, *Department of Conservation, Cornell University, Ithaca, New York, January 30, 1958.*

A Record of the White-headed Marsh Tyrant from the State of Rio Grande do Sul, Brazil.—The acquisition of two specimens of the White-headed Marsh Tyrant (*Arundinicola leucocephala*) by the United States National Museum definitely places this form on the list for the State of Rio Grande do Sul. In the Catalogue of Birds of the British Museum (Vol. 14, 1888:38) an adult male skin is recorded from the state at Pelotas. However, von Ihering (Ibis, 7th ser., 5, 1899:432) presents evidence for considering the locality erroneous. An editorial note at the termination of the article also states that the locality data are quite unreliable.

The range of this species is recorded by Cory and Hellmayr (Catalogue of Birds of the Americas, vol. 5, 1927:86) as occurring in "Brazil . . . south to São Paulo and Matto Grosso." O. Pinto (Catálogo das Aves do Brasil, pt. 2, 1944:123) cites a literature reference (J. Sztolcman, Ann. Zool. Mus. Polon. Hist. Nat., 5, no. 3, 1926:158) for placing the southernmost extension in Brazil at Invernadinha, Paraná. However, the date of collection and the collector's sojourn at that locality do not coincide. The specimen was collected at Rio de Janeiro on January 8, 1922, while the stay at Invernadinha was from April 28 to May 14, 1922. This discrepancy would then place the southern limit of occurrence in Brazil as stated by Cory and Hellmayr.

The specimens are United States National Museum nos. 461528–9. They are, respectively, a male and female taken at Guaíba, Rio Grande do Sul, Brazil, on August 1, 1948, by J. Belton. The locality Guaíba does not appear on any of the maps or in any of the gazeteers which I have consulted. However, in a letter from the American Consul at Pôrto Alegre, R. B. Jordan, it is stated that "Guaíba (formerly Pedras Brancas) . . . is located opposite . . . Pôrto Alegre . . . across the Guaíba River. Its latitude is 30°1′ 53″ S, longitude 51° 13′ 19″ W."—BERNARD FEINSTEIN, *Smithsonian Institution, Washington, D.C., December 5, 1957.*

The Nest and Eggs of the White-throated Flycatcher.—On July 7, 1956, I collected a breeding pair of White-throated Flycatchers (*Empidonax albigularis timidus*), their nest, and three fresh eggs about 2 miles south-southwest of El Salto, state of Durango, México. I have found no description of the nest and eggs of this species in the literature.

The locality at which these specimens were taken must be close to, if not at the point at which E. A. Goldman and E. W. Nelson took the type specimen of this form on July 17, 1898. It is along the small stream which flows through the lumbering town of El Salto. Near the town the borders of the stream are heavily overgrazed and devoid of brush or tall bunch grasses. Two miles upstream from the village there is a small forestry nursery which has been fenced in to protect it from grazing by domestic animals. The dominant trees of the valley slopes and open park-like valley bottom (fig. 1*a*) are several species of pine, including *Pinus cooperi, P. teocote,* and *P. ayacahuite*. Along the streambanks within the fenced-in area are patches of bushes, including *Salix* sp., *Symphoricarpos microphyllus,* and *Cornus stolonifera*. Shorter grasses and forbs grow luxuriantly in the openings.

The active nest (MMNH nest and egg coll. no. 1750) was about three feet above ground in a vertical crotch of a small willow (fig. 1*b*). The shrub was growing at the edge of the stream. A second nest was found in a similar willow that had been partly tipped over and submerged by high waters earlier in the year. When it was found on July 6, the nest was caked with dried aquatic plants. There were no eggs in this nest.

The thick walls of both nests are composed of seedless heads and other fine parts of dried grasses.

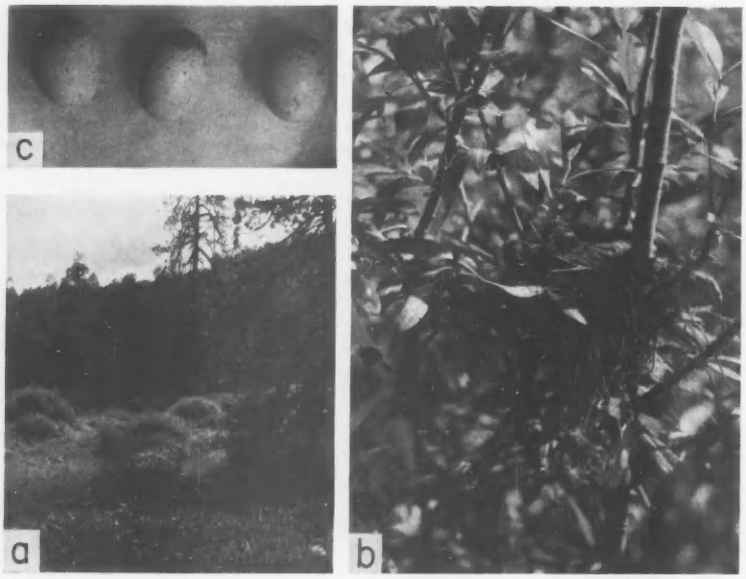

Fig. 1. (*a*) Nesting habitat, (*b*) nest, and (*c*) eggs of the White-throated Flycatcher (*Empidonax albigularis timidus*). Photographs *a* and *b* were taken near El Salto, Durango, on July 7, 1956.

The cups are lined with similar but finer material. The nests were measured in the field before they were distorted by wrapping and packing for shipment. They measured: outside diameter, 80 and 75×85 mm.; outside depth, 70 and 64 mm.; diameter inside nest cup, 48 and 48 mm.; inside depth, 38 and 36 mm. The color of the eggs is creamy, with a wreath or crown of burnt umber spots and splotches circling the larger end (fig. 1*c*). The three eggs measured: 17.2×13.2, 17.8×12.5, and 17.3×13.1 mm.

The adults are very dissimilar in appearance. The female appears to be in almost fresh plumage, with both the primaries and rectrices graduating to apiculate tips. The male is badly worn and faded; the ends of his primaries are rounded, although some of the rectrices still have their original tips. In coloration the female is paler, near Light Brownish Olive of Ridgway's Color Standard, while the worn male approaches Olive Brown. The top of the head of the male, with the feathers worn to thin, dark centers, is darker and browner, contrasting more sharply with the back than it does in the female. Ventrally the female is creamy to buffy-yellow, with a cast of buffy-olive on the sides and flanks. The male is faded to a dirty cream color with nearly grayish-olive sides and flanks.

The female (MMNH 13943) weighed 11.0 grams and measures: wing 59.0; tail 53.0 mm. The male (MMNH 13942) weighed 10.4 grams and measures: wing, 62.0; tail, 55.0 mm.—ROBERT W. DICKERMAN, *University of Minnesota Museum of Natural History, Minneapolis, Minnesota, December 9, 1957.*

NOTES AND NEWS

Publication of the color plate of the Fiery-billed Araçari by Don R. Eckelberry in this issue was made possible through the contribution of an anonymous donor.

The Division of Biological and Medical Sciences of the National Science Foundation announces that the next closing date for receipt of basic research proposals in the life sciences is September 15, 1958. Proposals received prior to that date will be reviewed at the Fall meetings of the Foundation's Advisory Panels and disposition will be made approximately four months following the closing date. Proposals received after the September 15, 1958, closing date will be reviewed following the Winter closing date of January 15, 1959. Inquiries should be addressed to the National Science Foundation, Washington 25, D. C.

COOPER SOCIETY MEETINGS

NORTHERN DIVISION

DECEMBER.—The monthly meeting of the Northern Division was held on December 5, 1957, at the University of California, Berkeley. The following names were proposed for membership: Ernest B. Woon, 1061 Glen Arbor Road, Ben Lomond, Calif., and Mervin A. Giuntoli, 3100 Vistamont Drive, San Jose, Calif., by L. Richard Mewaldt.

President McLean appointed the following committee to nominate officers for 1958: Enid Austin, Howard Cogswell, and L. Richard Mewaldt.

Alden H. Miller saw a Harlequin Duck at Pedro Point, near Pacifica, on November 18. Of added interest was the sighting of a Mockingbird near the same spot in this rather barren coastal situation. Don McLean reported that the Game Warden at Santa Cruz has observed an increase in Mockingbirds there. The Warden estimated that five pairs nested in Santa Cruz in 1957. McLean also reported seeing numbers of Sandhill Cranes and Mountain Plover on a recent visit to the Carrizo Plain of San Luis Obispo County.

The speakers of the evening were Dr. and Mrs. Eric Reynolds, who presented an excellent film and narrative on some birds of Venezuela, Jamaica, and Dutch Guiana.—L. RICHARD MEWALDT, *Secretary pro tem.*

JANUARY.—The monthly meeting of the Northern Division was held on January 2, 1958, at the University of California, Berkeley. The following name was proposed for membership: James H. McGammon, 2208 Rockbridge, Sacramento, California, by L. Richard Mewaldt.

Enid Austin, chairman of the Nominating Committee, presented the following slate of nominees for officers for 1958: President, John Davis; First Vice-President, A. Starker Leopold; Second Vice-President, Howard L. Cogswell; Secretary, Robert I. Bowman. It was moved, seconded, and passed that the nominations be closed and that the secretary be instructed to cast an unanimous ballot for the slate of officers as presented. Junea Kelly offered the following resolution: "Be it resolved that the members of the Northern Division of the Cooper Ornithological Society do hereby express their appreciation to our retiring president Donald D. McLean for the excellent services he has rendered the Society." This resolution was unanimously adopted.

On December 20, 1957, southwest of Thornton on Woodbridge Road, large numbers of cranes were observed by Mrs. Edith Nelson. Robert Bowman reported several Mockingbirds wintering in the vicinity of his home. Dr. L. Richard Mewaldt, with Dr. Henry Weston and Ernie Woon, on a trip to Pigeon Point had netted in one set and drive six kinds of *Zonotrichia*. These were *Zonotrichia leucophrys nuttalli, pugetensis,* and *gambelii,* Golden-crowned Sparrows, one Harris' Sparrow, and one White-throated Sparrow. Paul Covel stated that on the Christmas Census in the East Bay, a male Western Tanager in winter plumage was seen at a feeding station where it has been all winter. Jack Guggolz reported 500 to 1000 Starlings in Richmond just before Christmas. Reporting on the Christmas Census at Tomales Bay, Allan Craig stated that two White-throated Sparrows were seen at a feeding station in Inverness. A Yellow-shafted Flicker was also seen.

Peter Schramm, of the University of California, gave a talk on "A Summer Collecting Trip to Chihuahua, México."—LILLIAN HENNINGSEN, *Secretary.*

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OF THE

COOPER ORNITHOLOGICAL SOCIETY

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Revised to June 27, 1958

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Year following address indicates date of election to membership. Year in parentheses indicates date of advancement to Honorary or Life Membership. [L.] = Life Member.

A

Abbott, Jackson M., 814 13th St., New Alexandria, Va. 1957.

Abdulali, Humayun, 75 Abdul Rehman St., Bombay 3, India. 1947.

Abowitz, Murray, 6333 Wilshire Blvd., Los Angeles 48, Calif. 1958.

Adams, Capt. Claude T., W.A.D.C., Area B, Box 8607, Wright-Patterson AFB, Ohio. 1951.

Adams, Heman P., Glenville State College, Glenville, W. Va. 1956.

Adams, William H., Jr., Wildlife Research Unit, Wildlife Bldg., Auburn, Ala. 1952 (1958) [L.].

Adelson, Richard H., 34 Wensley Dr., Great Neck, N. Y. 1950.

Albright, Ray, Rt. 1, Box 277, Dayton, Ore. 1950.

Albro, Mary S., 29 Mosswood Rd., Berkeley 4, Calif. 1928.

Alcorn, Gordon D., College of Puget Sound, Tacoma 6, Wash. 1942.

Alcorn, Joseph R., Univ. Kansas, Museum Natural History, Lawrence, Kan. 1939 (1947) [L.].

Aldrich, Elmer C., 5631 Camellia Ave., Sacramento 19, Calif. 1935.

Aldrich, John W., 21 W. Spring St., Alexandria, Va. 1942.

Alexander, Gordon, Biology Dept., Univ. Colorado, Boulder, Colo. 1941.

Alexander, Helen M., 2121 W. 9th St., Los Angeles 6, Calif. 1958.

Allen, Alice G., 143 W. Acadia, Apt. 4, Stockton 3, Calif. 1957.

Allen, Arthur A., Cornell Univ., Ithaca, N. Y. 1911.

Allen, Esther C., Camarillo State Hospital, Camarillo, Calif. 1951.

Allen, Frederick W., Jr., % The Yankee Traveler, Warren Ave., Plymouth, Mass. 1956.

Allen, George A., 1328 Allen Park Dr., Salt Lake City 5, Utah. 1957.

Allen, Herbert, 822 Wildrose Ave., Monrovia, Calif. 1956.
Allin, Albert E., 404 S. Norah St., Fort William, Ontario, Canada. 1956.
Alperin, Irwin M., 187 Cedar Lane, Babylon, N.Y. 1947.
Altmann, Stuart A., Rm. 112, Bldg. 9, National Inst. Health, Bethesda 14, Md. 1955.
Alvarez del Toro, Miguel, Apartado Postal No. 6, Tuxtla Gutierrez, Chiapas, Mex. 1948.
Amadon, Dean, American Museum of Natural History, Central Park West at 79th St., New York 24, N. Y. 1943.
Anderson, Allen E., 37 Orchard Park, Dexter, N. M. 1956.
Anderson, Anders H., 3221 E. Kleindale Rd., Tucson, Ariz. 1932.
Anderson, Charles H., 1015 Connely St., Salinas, Calif. 1947.
Anderson, Earl A., 7335 N. Odell Ave., Chicago 31, Ill. 1952.
Anderson, Eugene N., Jr., 318 23rd St., Santa Monica, Calif. 1957.
Anderson, Frank G., Sociology Dept., Univ. Maryland, College Park, Md. 1951.
Anderson, James D., Museum of Vertebrate Zoology, Berkeley 4, Calif. 1954.
Anderson, Sydney, Museum of Natural History, Univ. Kansas, Lawrence, Kan. 1957.
Anderson, William, Box 983, Los Banos, Calif. 1948.
Andrews, Arthur A., 75 Penfield Crescent, Brighton Sta., Rochester 10, N. Y. 1927.
Annan, Ormsby, 270 Birch St., Winnetka, Ill. 1951. (1954) [L.].
Antevs, Ada, "The Corral," Globe, Ariz. 1946 (1947) [L.].
Appelman, F. J., Stichting Rotterdamsche Diergaarde, Rotterdam, Netherlands. 1953.
Applegarth, John H., Box 10, California Polytechnic College, San Luis Obispo, Calif. 1937.
Appleton, J. S., R.F.D., Simi, Calif. 1901 (1920) [L.].
Arbib, Robert S., Jr., 807 Crystal Springs Rd., Hillsborough, Calif. 1947.
Argante, Mrs. A. J., 5248 T St., Sacramento 17, Calif. 1955.
Armington, Sven, Sveriges Ornitologiska Forening, Ostermalmsgatan 65, Stockholm 0, Sweden. 1951.
Armstrong, Fairbearn H., Box 97, Pomeroy, Wash. 1954.
Armstrong, Virginia, Old Concord Rd., South Lincoln, Mass. 1947.
Arnold, Hubert A., 533 E St., Davis, Calif. 1956.
Arnold, John R., 834 W. Mariposa St., Stockton 4, Calif. 1930.
Arnold, Ralph, 324 W. Arrelloga, Santa Barbara, Calif. 1893.
Arny, Samuel A., 6515 Williston Dr., Apt. 2, Falls Church, Va. 1947.
Aronoff, Arthur E., 11 Fifth Ave., New York 3, N. Y. 1948 (1955) [L.].
Arsenault, Barbara J., 16025 Miami Way, Pacific Palisades, Calif. 1954.
Arvey, M. Dale, Biology Dept., Long Beach State College, 6101 E. 7th St., Long Beach 4, Calif. 1953.
Ashcraft, Granville P., Box 438, Etna, Calif. 1940.
Atsatt, Sarah R., 1130 N. Monterey St., Alhambra, Calif. 1911.
Austin, Mrs. Harold C., 1116 Mandana Blvd., Oakland 10, Calif. 1939.
Austin, Oliver L., 28 Fairview Ave., Box 146, Tuckahoe 7, N. Y. 1931.
Avent, Carrie P., Minter City, Miss. 1957.
Ayer, Mrs. N. Edward, 1300 Hillcrest Dr., Pomona, Calif. 1929.

B

Badger, M. C., Rt. 1, Box 98, Santa Paula, Calif. 1915.
Baepler, Donald H., Zoology Dept., Univ. Oklahoma, Norman, Okla. 1956.
Bailey, Alfred M., Colorado Museum of Natural History, Denver 6, Colo. 1917.
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Bailey, Richard, 1107 High Court, Berkeley 8, Calif. 1949.
Baird, James, Norman Bird Sanctuary, Third Beach Rd., Newport, R. I. 1957. (1957) [L.].
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Baker, Paul S., 21 Woodlot Lane, Huntington, L. I., N. Y. 1945.
Baker, Rollin H., The Museum, Michigan State Univ., East Lansing, Mich. 1946.
Bakker, Gerhard, Jr., 450 W. Ave. 43, Los Angeles 65, Calif. 1954.
Bakus, Gerald J., 18624 48th Ave. W., Lynnwood, Wash. 1958.
Balch, T. E., Box 9, Glenn, Calif. 1957.
Baldwin, Paul H., 1205 Remington St., Fort Collins, Colo. 1943.
Baldwin, William G., Eye & Ear Hospital, Box 1627, Wenatchee, Wash. 1953.
Balsom, Mrs. Amos P., 2209 E. Stratford Court, Milwaukee 11, Wis. 1948.
Baltzar, Evelyn C., 15057 Starbruck Ave., Whittier, Calif. 1946.
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Barnes, F. R., 4282 Maple Ave., Oakland 2, Calif. 1947.
Barrett, Vernon, 1300 Chelton Way, South Pasadena, Calif. 1948.

Bartel, James N., 1741 Denison St., Pomona, Calif. 1951.
Barth, R. H., Jr., Biological Labs., Harvard Univ., Cambridge 38, Mass. 1957.
Bartholomew, George A., Jr., Zoology Dept., Univ. California, Los Angeles 24, Calif. 1942.
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Basey, Harold E., Box 62, Riverdale, Calif. 1954.
Bassett, Frank N., 722 N. Orange Dr., Los Angeles 38, Calif. 1919.
Battles, Carroll D., 2347 S. Highland Ave., Los Angeles 16, Calif. 1924.
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Bayly, Bob, 1759 Franklin Blvd., Eugene, Ore. 1956.
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Beckwith, William C., 833 15th St., Santa Monica, Calif. 1958.
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Bell, A. Weir, 365 S. Hoover St., Los Angeles 5, Calif. 1936.
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Belt, Charles B., 233 Broadway, New York 7, N. Y. 1956.
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Bender, Richard O., Cobb's Mill Rd., R. D. 1, Bridgeton, N. J. 1951.
Benjamin, Gilbert G., Jr., 11554 McLennan Ave., Granada Hills, Calif. 1939.
Benne, Bartles L., 338 N. Van Brunt, Kansas City 23, Mo. 1956.
Bennett, Walter W., 7828 Santa Monica Blvd., Hollywood 46, Calif. 1934.
Benson, Seth B., 645 Coventry Rd., Berkeley 7, Calif. 1927.
Berger, Andrew J., Anatomy Dept., East Medical Bldg., Univ. Michigan, Ann Arbor, Mich. 1947.
Berger, Daniel D., 510 E. MacArthur Rd., Milwaukee 17, Wis. 1954.
Bergstrom, E. Alexander, 37 Old Brook Rd., West Hartford 7, Conn. 1942.
Berry, William D., 653 Noe St., San Francisco 14, Calif. 1951.
Berryman, Carl W., 128 W. Euclid Ave., Stockton 4, Calif. 1953.
Berwick, Freda W., Room 548, Mills Tower, 220 Bush St., San Francisco 4, Calif. 1955.
Bialac, James T., 4706 N. 16th Dr., Apt. 4, Phoenix, Ariz. 1955.
Bibbee, Paul C., Concord College, Athens 4, West Va. 1947.
Biddle, John A., 418 Westbourne St., La Jolla, Calif. 1947.
Bigelow, Mrs. A. P., 540 E. 7th St., Oakland 6, Calif. 1956.
Binder, Kay, 3838 W. 61st., Chicago 29, Ill. 1958.
Binford, Laurence C., 330 Grove St., Glencoe, Ill. 1955.
Bird, Dick, 2721 Assiniboine Ave., Regina, Saskatchewan, Canada. 1956.
Blackford, John L., Libby, Mont. 1952 (1952) [L.].
Blackstone, Robert E., 10363 Calvin Ave., Los Angeles 25, Calif. 1953.
Blain, Alexander W., 1028 Berkshire Rd., Grosse Pointe 30, Mich. 1926.
Blake, Charles H., Box 613, Hillsboro, N. C. 1947.
Blake, Emmet R., Chicago Natural History Museum, Roosevelt Rd. and Lake Shore Dr., Chicago 5, Ill. 1956.
Blanchard, Dean H., 729 Mission Canyon Rd., Santa Barbara, Calif. 1937.
Bleitz, Don, 2047 Castilian Dr., Hollywood 28, Calif. 1944 (1952) [L.].
Boag, D. A., "Kilmagar," Volmer P. O., Alberta, Canada. 1957.
Bock, Walter, Biological Labs., Harvard Univ., Cambridge 38, Mass. 1954.
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Bolander, Gordon L., 4411 Guerneville Rd., Santa Rosa, Calif. 1943.
Boltz, Donald A., 1556 Brentwood Court, Walnut Creek, Calif. 1958.
Bond, Richard M., Virgin Islands Corp., Kingshill, St. Croix, U. S. Virgin Islands. 1936.
Booth, Ernest S., Box 48, College Place, Wash. 1939.
Booth, Katherine F., 1085 Bank St., Painesville, Ohio. 1953.
Borell, Adrey E., Soil Conservation Service, 321 New Custom House, Denever 2, Colo. 1918.
Bosbyshell, F. H., 545 S. Figueroa St., Los Angeles 17, Calif. 1951.
Bourlière, F., 15 Avenue de Tourville, Paris 7, France. 1956.
Bourne, Raymond D., Box 187, Oxford, Ohio. 1947 (1951) [L.].
Bowdish, B. S., 16 Van Horn St., Demarest, N.J. 1910.
Bowen, Lydia S., 841 Earlham St., Pasadena 4, Calif. 1948.
Bowers, Darl E., Mills College, Oakland 13, Calif. 1949.
Bowers, J. Basil, 22275 Lantis Lane, Los Altos, Calif. 1947.
Bowles, John, 541 Ravenna Blvd., Seattle 15, Wash. 1957.
Bowman, Mabelle D., 51 Marr Ave., Oakland 11, Calif. 1949.
Bowman, Robert I., 1069 Sterling Ave., Berkeley 8, Calif. 1948.
Boyd, J. E., 3640 Los Feliz Court, Riverside, Calif. 1957.
Boyer, Paula S., 420 E. 2nd St., Roselle, N. J. 1958.
Boyle, Ashby D., 865 S. 19th East, Salt Lake City 5, Utah. 1915.
Boyne, Elmer M., 624 Nixon Ave., Reno, Nev. 1951.
Boynton, F. H., 163 W. State St., Pasadena 2, Calif. 1948.
Bracelin, Mrs. H. P., 2214 Vine St., Berkeley 9, Calif. 1930.
Brackbill, Hervey G., 2620 Poplar Dr., Baltimore 7, Md. 1945.
Bradburn, Donald M., 461 Pine St., New Orleans 18, La. 1953.
Brandt, John H., Trust Territory of Pacific Islands, Truk, East Caroline Islands, via Guam. 1956.
Brattstrom, Bayard H., Biology Dept., Adelphi College, Garden City, N. Y. 1956.
Brauner, Joseph, 3855 Potomac Ave., Los Angeles 8, Calif. 1946.
Breitenbach, Robert P., Dept. Zoology, Univ. Wisconsin-Milwaukee, Milwaukee 11, Wis. 1957.
Brem, George, Jr., 211 N. Princevalle St., Gilroy, Calif. 1958.
Brittan, Martin R., Life Sciences Dept., Sacramento State College, 6000 J St., Sacramento 19, Calif. 1948.
Broadbooks, Harold E., Southern Illinois Univ., Alton, Ill. 1942.
Brode, J. Stanley, 478 24th St., Santa Monica, Calif. 1934.
Brodkorb, Pierce, Biology Dept., Univ. Florida, Gainesville, Fla. 1940.
Brodrick, Neva M., 721 Cleveland Ave., Oakland 6, Calif. 1949.
Brody, Gerald L., University Hospital, Univ. Michigan, Ann Arbor, Mich. 1955.
Bromley, Stephen C., 9359 Gotham St., Downey, Calif. 1958.
Brooks, Matilda M., 630 Woodmont Ave., Berkeley 8, Calif. 1949.
Brooks, William E., Rt. 1, Box 100, Colton, Calif. 1940.
Brown, Asa L., Janesville, Calif. 1938.
Brown, Jerram L., Museum of Vertebrate Zoology, Berkeley 4, Calif. 1952.
Brown, Martin D., Jr., 9131 Canfield Dr., Whittier, Calif. 1954.
Brown, Ollie D., 8964 Wonderland Ave., Los Angeles 46, Calif. 1952.
Brown, Richard M., Crater Lake National Park, Fort Klamath Rural Sta., Klamath Falls, Ore. 1958.
Brown, Mrs. Thomas H., 4254 Ampudia St., San Diego 3, Calif. 1946.
Brown, William L., 173 Hillhurst Blvd., Toronto, Ontario, Canada. 1957.
Browne, Andrew C., 67 Santa Maria Ave., Portola Valley, Calif. 1950.
Bruns, James H., 1820 Jefferson Ave., Apt. 3, New Orleans 1, La. 1949.
Bryant, Harold C., 245 Glorietta Blvd., Orinda, Calif. 1910 (1920) [L.].
Bryant, Wayne W., Grand Teton National Park, Moose, Wyo. 1952.
Bryens, Oscar McK., Route 1, White Pigeon, Mich. 1927.
Bull, Dan B., Box 608, La Mesa, Calif. 1950.
Burch, Mrs. John Q., 4206 Halldale Ave., Los Angeles 62, Calif. 1947.
Burkhart, Harriet H., Rt. 3, Canadohta Lake, Union City, Pa. 1958.
Burleigh, Thomas D., College of Forestry, Univ. Idaho, Moscow, Idaho. 1956.
Burns, Robert D., Zoology Dept., Michigan State Univ., East Lansing, Mich. 1954.
Bursewicz, John, 14 Chapin St., Jamestown, N.Y. 1958.
Burt, William H., Museum of Zoology, Univ. Michigan, Ann Arbor, Mich. 1928.
Burtis, Prentis T., Jr., 1184 Palo Alto Ave., Palo Alto, Calif. 1956.
Burton, Donald E., 171 Strathearn Rd., Toronto 10, Ontario, Canada. 1955.

Bushman, John B., Ecological Research, Univ. Utah, Dugway, Utah. 1952.
Buss, Irven O., Zoology Dept., Washington State College, Pullman, Wash. 1955.
Butler, Thomas S., 10302 Knob Oak, Houston 24, Texas. 1955.

C

Cade, Tom J., 3353 S. Lucile Lane, Lafayette, Calif. 1950.
Cady, Walter G., 3350 Calvert Dr., Pasadena 8, Calif. 1951.
Cahalane, Victor H., 80 Fernbank Ave., Delmar, N. Y. 1938.
Calder, James A., 6851 Orangethorpe, Buena Park, Calif. 1917.
Calef, Robert T., 821 Granger St., Ann Arbor, Mich. 1955.
Camp, Charles L., Museum of Paleontology, Univ. California, Berkeley 4, Calif. 1909.
Campbell, John M., Room 214, Peabody Museum, Yale Univ., New Haven, Conn. 1957.
Campbell, Raymond A., 686 Fourth Ave., Chula Vista, Calif. 1953.
Campbell, Mrs. William H., Rt. 2, Box 871-A, Tucson, Ariz. 1940.
Cannon, Jerauld C., 872 Rillito Ave., Tucson, Ariz. 1957.
Cardiff, Bruce E., 633 W. Randall Ave., Rialto, Calif. 1948.
Cardiff, Eugene A., 2736 Court St., Rialto, Calif. 1947.
Carey, Joshua H., Children's Hospital, 219 Bryant St., Buffalo 22, N. Y. 1936.
Carmony, D. Duane, Room 837, International House, Univ. California, Berkeley 4, Calif. 1955.
Carnes, Bettv, 31 Dogwood Lane, Tenafly, N. J. 1947.
Carson, Carl L., 67 Duncan Way, Oakland 11, Calif. 1948.
Carter, Dennis L., Museum Zoology, Louisiana State Univ., Baton Rouge 3, La. 1957.
Carter, E. W., 234 Muirfield Rd., Los Angeles, Calif. 1958.
Carter, Frances, 2200 College Ave., Berkeley 4, Calif. 1934.
Cassel, J. Frank, Zoology Dept., North Dakota Agr. College, Fargo, N. D. 1946.
Castenholz, Richard W., Biology Dept., Univ. Oregon, Eugene, Ore. 1955.
Caswell, Herbert H., Jr., Eastern Michigan College, Ypsilanti, Mich. 1950.
Chalif, Edward L., 37 Barnsdale Rd., Short Hills, N. J. 1948 (1952) [L.].
Chamberlain, Samuel R., Box 593, Refugio, Texas. 1957.
Chambers, Carl W., 514 Marquette St., Pacific Palisades, Calif. 1936.
Chambers, W. Lee, R. R. 1, Box 410, Topanga, Calif. 1897 (1919) [L.], (1936) [Honorary].
Chaney, Hope B., 932 Tiverton Ave., Los Angeles 24, Calif. 1957.
Chaniot, George E., Jr., 1069 W. Prairie, Decatur, Ill. 1957.
Chapelle, Lt. Col. Francis O., Qtrs. 15, West Point, N. Y. 1954.
Childs, Henry E., Jr., 15053 Neartree St., La Mirada, Calif. 1947.
Christensen, Frank, 7037 Alvern St., Apt. C., Los Angeles 45, Calif. 1957.
Christensen, Ruth, 7037 Alvern St., Apt. C., Los Angeles 45, Calif. 1953.
Christman, Gene M., Museum of Vertebrate Zoology, Berkeley 4, Calif. 1946.
Church, Ronald L., 2735 Regent St., Apt. 5, Berkeley, Calif. 1954.
Clapp, Clara M., 3962 Dalton Ave., Los Angeles 62, Calif. 1956.
Clark, Ervil D., Pacific Union College, Angwin, Calif. 1957.
Clark, George A., Jr., Osborn Zoological Lab., Yale Univ., New Haven, Conn. 1956.
Clarke, Oscar F., 1012 Indianapolis Ave., Riverside, Calif. 1951.
Clarke, William S., Jr., Box 167, State College, Pa. 1948.
Clarkson, Mrs. Edwin O., Wing Haven, 248 Ridgewood Ave., Charlotte, N.C. 1945 (1953) [L.].
Clary, Marjorie D., 7630 Cimarron St., Los Angeles 47, Calif. 1929.
Clattenburg, Albert E., Jr., 4764 33rd St. North, Arlington 7, Va. 1947.
Clay, C. Irvin, Box 353, Eureka, Calif. 1910 (1923) [L.].
Clements, H. Everest, 49 Stoneham Rd., Rochester 10, N. Y. 1951 (1951) [L.].
Clow, Marion, Box 163, Lake Forest, Ill. 1945.
Clyde, Mrs. Brooke, 201 Laurel St., San Francisco 18, Calif. 1957.
Coakley, Katharine T., Mariposa, Calif. 1954.
Coble, Mary F., 1357 N. Stanley Dr., Hollywood 46, Calif. 1954.
Coffey, Ben B., Jr., 907 Union Planters Bldg., Memphis 3, Tenn. 1957.
Coggeshall, Robert D., Billington Rd., East Aurora, N. Y. 1956.
Coggins, Herbert L., 2764 Filbert St., San Francisco 9, Calif. 1910.
Cogswell, Howard L., Biological Sciences Dept., Mills College, Oakland 13, Calif. 1940.
Coil, E. Fisher, 3047 Union St., San Diego, Calif. 1951.
Colburn, Paul W., 9626 Oak Pass Rd., Beverly Hills, Calif. 1957.
Cole, Mrs. Whiteford R., Jr., 1746 Sulgrave Rd., Louisville 5, Ky. 1956.

Cole, William W., Jr., 6205 Howe St., Pittsburgh, Pa. 1956.
Collier, Gerald, 3634 N. Muscatel Ave., Rosemead, Calif. 1953.
Colton, Harold S., Museum of Northern Arizona, Box 601, Flagstaff, Ariz. 1936.
Colvin, Lily, 11937 Goshen Ave., Los Angeles 49, Calif. 1957.
Combellack, Rose, 3021 Friendly St., Eugene, Ore. 1952.
Compton, Lawrence V., Biology Div., Soil Conservation Service, Washington 25, D. C. 1927.
Cone, Lt. Col. Hutchinson I., Jr., H.Q. U. S. Forces Japan, Box 690, APO 925, San Francisco, Calif. 1940.
Connon, Herald, 288 Lester Ave., Oakland 6, Calif. 1958.
Constable, Robert S., 6521 Blucher Ave., Van Nuys, Calif. 1958.
Cooch, Graham, 685 Echo Dr., Ottawa 1, Ontario, Canada. 1954.
Cooper, Ruth B., 2820 Prince St., Berkeley 5, Calif. 1944.
Cope, James B., Earlham College, Richmond, Ind. 1957.
Cottam, Clarence, Welder Wildlife Foundation, Box 1396, Sinton, Texas. 1926.
Cottrell, George W., Jr., 70 Lake View Ave., Cambridge 38, Mass. 1945.
Couffer, Jack C., 3099 Ellington Dr., Hollywood 28, Calif. 1942.
Courtright, Mary L., 3 Elm Ave., Larkspur, Calif. 1936.
Covel, Paul F., 2860 Delaware St., Oakland 2, Calif. 1935.
Cowan, Ian McT., Zoology Dept., Univ. British Columbia, Vancouver, B. C., Canada. 1937.
Cowles, Raymond B., Zoology Dept., Univ. California, Los Angeles 24, Calif. 1928.
Craig, Alan M., 5401 Fair Oaks Blvd., Carmichael, Calif. 1954.
Craig, Ethel B., 4309 Victoria Ave., Los Angeles 8, Calif. 1956.
Cramer, Frances L., 921 W. 36th Pl., Los Angeles 7, Calif. 1940 (1943) [L.].
Crawford, Franklin G., 3279 Rubio Canyon Rd., Altadena, Calif. 1939.
Crippen, Robert G., Museum of Vertebrate Zoology, Berkeley 4, Calif. 1958.
Crompton, Alfred O., Laurie Ave., Salisbury, South Australia. 1948.
Crouch, James E., San Diego State College, San Diego, Calif. 1934.
Crowell, John B., Jr., 535 Jefferson Ave., Elizabeth 4, N. J. 1956.
Crowley, Lawrence D., 1212 Cascade St., Boulder, Colo. 1956.
Culbertson, A. E., 1047 Overlook Rd., Berkeley 8, Calif. 1937.
Cunningham, James W., 3009 E. 19th Terr., Kansas City 27, Mo. 1945.
Curl, A. Lawrence, 751 Balra Dr., El Cerrito 8, Calif. 1947.
Curry-Lindahl, Kai, Zoological Dept., Nordiska Museet and Skansen, Stockholm, Sweden. 1957.
Curtis, Gordon, 17-B Lorton Ave., Burlingame, Calif. 1957.
Curtis, Vee K., 2412 Cohasset Rd., Chico, Calif. 1945.
Cuthbert, N. L., 1001 S. Franklin St., Mount Pleasant, Mich. 1953.
Cutler, Betsey D., 2680 Bell St., Sacramento, Calif. 1955.
Cutler, Henry H., 5 Shelley Rd., Wellesley Hills 81, Mass. 1956.

D

Dahl, Richard G., 47 Lakemont Dr., Daly City, Calif. 1938.
Dales, Loring G., 1555 Club View Dr., Los Angeles 24, Calif. 1955.
Daly, Brian, 445 Magellan Ave., San Francisco 16, Calif. 1956.
D'Angelo, Angelo R., 32 Hamilton Ave., Hasbrouck Heights, N. J. 1947.
Darby, Rollo E., 2103 Walnut Ave., Carmichael, Calif. 1946.
Davidson, John B., 18472 E. La Veta, Orange, Calif. 1950.
Davidson, W. M., 1504 Bodell St., Orlando, Fla. 1947.
Davies, Mildred V., 1019 W. 23rd St., Upland, Calif. 1958.
Davis, Clifford V., 910 S. Sixth St., Bozeman, Mont. 1948.
Davis, David E., 615 N. Wolfe St., Baltimore 5, Md. 1936.
Davis, Donald G., Box 145, Timnath, Colo. 1958.
Davis, Edwin G., 1316 22nd St. S., Arlington 2, Va. 1936.
Davis, Henry R., 418 Floral Park Terr., South Pasadena, Calif. 1953 (1953) [L.].
Davis, John, Hastings Natural History Reservation, Jamesburg Rt., Carmel Valley, Calif. 1938.
Davis, L. Irby, 1122 E. Polk St., Harlingen, Texas. 1940.
Davis, William B., Box 254, Faculty Exchange, College Station, Texas. 1930 (1950) [L.].
Dawson, William R., Zoology Dept., Univ. Michigan, Ann Arbor, Mich. 1945.
Day, Leonard H., Box 126, Davis, Calif. 1944.
Daynes, Donald, 1812 Herbert Ave., Salt Lake City, Utah. 1958.
Dearborn, John H., 119 Stanford Village, Stanford, Calif. 1958.
DeGroot, Dudley S., O.C.S.S., S.A.D., USAR-Eur., APO 245, New York, N. Y. 1916.
Deignan, Herbert G., 2236 Decatur Pl. N. W., Washington 6, D. C. 1949.

Delacour, Jean, Los Angeles County Museum, Exposition Park, Los Angeles 7, Calif. 1927 (1949) [L.].

Dengler, Herbert J., 219 Wyndham Dr., Woodside, Calif. 1958.

Denham, Reginald H., 100 Central Park South, New York 19, N. Y. 1948.

Denton, J. Fred, 1510 Pendleton Rd., Augusta, Ga. 1949.

De Schauensee, R. M., Jongleur Farm, S. Devon Ave., Devon, Pa. 1950.

Desmond, Thomas C., Box 670, Newburgh, N. Y. 1945 (1948) [L.].

Deuel, Harold F., 110 Hill St., Arcata, Calif. 1951.

Deuprey, Mrs. Clifton S., 817 University St., Healdsburg, Calif. 1935.

Dick, John H., Dixie Plantation, Meggett, S. C. 1958.

Dickerman, Robert W., Museum of Natural History, Univ. Minnesota, Minneapolis, Minn. 1951.

Dickie, Eva S., 3840 Loquat Ave., Miami 33, Fla. 1957.

Dietz, Curt, Box 3039, Stanford, Calif. 1950.

Dignam, John H., 51 Bishop Ave., Willowdale, Ontario, Canada. 1954.

Dilger, William C., Laboratory of Ornithology, Cornell Univ., Ithaca, N. Y. 1952.

Dirks-Edmunds, Jane C., Linfield College, McMinnville, Ore. 1948.

Dixon, James B., 2266 Cranston Dr., Escondido, Calif. 1924.

Dixon, James E., Rt. 1, Box 73, Escondido, Calif. 1948 (1954) [L.].

Dixon, Keith L., Wildlife Management Dept., Texas A. & M. College, College Station, Texas. 1943.

Dixon, Ralph E., Box 981, Del Mar, Calif. 1935 (1954) [L.].

Dodds, Mrs. Paul D., 437 Emerald Bay, Laguna Beach, Calif. 1955.

Dodson, Leigh M., 351 N. Highland Ave., Los Angeles 36, Calif. 1929.

Doering, Hubert R., 242 E. Walton Pl., Chicago 11, Ill. 1946.

Dorsey, George A., Darlington School, Rome, Ga. 1957.

Dougan, Marjorie, 12849 Marlboro St., Los Angeles 49, Calif. 1955.

Downing, Kirk E., Box 489, Arkansas City, Kan. 1958.

Drake, Robert J., Zoology Dept., Univ. Arizona, Tucson, Ariz. 1957.

Dressel, Evan C., 1177 E. Western Reserve Rd., Poland 14, Ohio. 1956.

Drury, William H., Jr., Drumlin Farm, South Lincoln, Mass. 1955.

DuBois, Alexander D., Christmas Lake Road, Rt. 5, Excelsior, Minn. 1911.

DuBois, H. M., Rt. 1, Box 370, Clackamas, Ore. 1931.

Duff, C. V., 2911 Antelo View Dr., Los Angeles 24, Calif. 1939 (1950) [L.], (1957) [Honorary].

Duff, James V., 7450 Balboa Blvd., Van Nuys, Calif. 1946.

Duffield, Marjorie O., 1472 Eskridge Way, Olympia, Wash. 1937.

DuMont, Philip A., 4114 Fessenden St. N.W., Washington 16, D. C. 1932.

Dunlap, Ava K., Pasatiempo Golf & Country Club, 14 Hollins Dr., Santa Cruz, Calif. 1947.

Dunn, Mrs. Joseph E. P., 1119 S. Highland Ave., Los Angeles 19, Calif. 1956.

Durham, Jane R., 968 Cragmont Ave., Berkeley 8, Calif. 1957.

Duvall, Allen J., Fish & Wildlife Service, Washington 25, D. C. 1946.

Dvorak, Joseph L., 6125 W. Eddy St., Chicago 34, Ill. 1958.

Dzubin, Alex, Canadian Wildlife Service, 317 Field Husbandry Bldg., Univ. Saskatchewan, Saskatoon, Saskatchewan, Canada. 1957.

E

Eaton, Stephen W., Biological Sciences Dept., St. Bonaventure Univ., St. Bonaventure, N. Y. 1948.

Ebert, Ruth B., 1703 E. Cliff Dr., Santa Cruz, Calif. 1941.

Eckelberry, Don R., 4 Foster Lane, Babylon, L. I., N. Y. 1948.

Edberg, Ragnar, Nygatan 49, Orebro, Sweden. 1953.

Eddy, Garrett, 4515 Ruffner St., Seattle 99, Wash. 1947.

Edeburn, Ralph M., Marshall College, Huntington 1, West Va. 1954.

Edens, Martha La Prelle, % Dorothy E. Groner, 4038½ Garden Ave., Los Angeles 39, Calif. 1949.

Edge, Mrs. Charles N., 1215 5th Ave., New York 29, N. Y. 1932.

Edwards, Ernest P., Houston Museum of Natural History, Hermann Park, Houston, Texas. 1953.

Edwards, Kenneth F., 169 Hillendale Ave., Bath Road P. O., Kingston, Ontario, Canada. 1955.

Einarsen, Arthur S., 9 Edgewood Way, Corvallis, Ore. 1936.

Einhorn, Benjamin, 7 Parker Ave., West Deal, N. J. 1947.

Eisenmann, Eugene, 110 W. 86th St., New York 24, N. Y. 1947 (1948) [L.].

Eklund, Carl M., Rocky Mountain Laboratory, Hamilton, Mont. 1951.

Elitharp, Marie, 221 Ten Eyck St., Watertown, N. Y. 1956.

Elmore, Louis A., 2002 Yolo Ave., Berkeley 7, Calif. 1935.

Ely, Charles A., Zoology Dept., Univ. Oklahoma, Norman, Okla. 1957.
Emerson, William S., American Potash & Chemical Corp., 201 W. Washington Blvd., Whittier, Calif. 1956.
Emilio, S. Gilbert, Rt. 4, Laconia, N. H. 1926.
Emlen, John T., Jr., Zoology Dept., Birge Hall, Univ. Wisconsin, Madison 5, Wis. 1930.
England, Ewin G., Box 130, Durham, Calif. 1940.
English, P. F., Agricultural Educ. Bldg., Pennsylvania State Univ., University Park, Pa. 1945.
Ennis, J. Harold, 323 Tenth Ave. S., Mount Vernon, Iowa. 1953.
Erickson, John G., 1344 S. 2nd St., Stillwater, Minn. 1951.
Erickson, Mary M., 3505 Foothill Rd., Santa Barbara, Calif. 1930.
Erwin, Robert J., 731 W. Cahoon St., Ogden, Utah. 1948.
Esbenshade, Anne W., 1185 Parkview Ave., Pasadena 3, Calif. 1956.
Escalante, Rodolfo, Juan Benito Blanco 1030, Apartado 201, Montevideo, Uruguay. 1958.
Esteban, Juan G., Instituto Miguel Lillo, Miguel Lillo 205, Tucuman, Argentina. 1949 (1949) [L.].
Evans, Cora L., 1444 Calhoun St., New Orleans 18, La. 1957.
Evans, L. Lloyd, 503 California Ave., Libby, Mont. 1958.
Evans, Lenore, Klamath Trout Hatchery, Klamath Agency, Ore. 1955.
Evenden, Fred G., 1336 Fitch Way, Sacramento 25, Calif. 1944.
Ewan, Joseph A., Botany Dept., Tulane Univ., New Orleans 18, La. 1937.
Eyster, Marshall B., 124 Dolores Dr., Lafayette, La. 1951.

F

Failing, Robert, 3949 Harmon Rd., El Sobrante 11, Calif. 1933.
Falconer, Donald M., 37 Saddleback Rd., Rolling Hills, Calif. 1950.
Farner, Donald S., Zoology Dept., State College of Washington, Pullman, Wash. 1945.
Fasnacht, Harry S., Union Deposit, Pa. 1957.
Fassero, James S., 4622 Loleta Ave., Eagle Rock, Calif. 1957.
Featherstone, Eileen C., 132 King St., Wallace, Idaho. 1951.
Feenaty, Eula, % Charles Stafford, 6623-A Rita Ave., Huntington Park, Calif. 1955.
Feingold, Rose, 4206 St. Charles Ave., New Orleans 15, La. 1957.
Feinstein, Bernard, 506 A St., N.E., Washington 2, D. C. 1957.
Felt, Arthur C., 617 N. Newlin Ave., Whittier, Calif. 1957.
Fennell, Chester M., 19239 Coffinberry Blvd., Fairview Park 26, Ohio. 1950.
Ferris, Reed, 941 S. 13th East, Salt Lake City, Utah. 1958.
Fevold, H. Richard, 221 S. 13th East, Salt Lake City 2, Utah. 1956.
Ficken, Robert W., 709 E. State St., Ithaca, N. Y. 1956.
Field, Ruby H., Box 276, Palos Verdes Estates, Calif. 1950.
Findley, James S., Biology Dept., Univ. New Mexico, Albuquerque, N. M. 1952.
Finley, Robert B., Jr., 7 Black Hawk Dr., Forest Heights, Washington 21, D. C. 1946.
Fischer, Daniel L., 4845 Central Ave., Riverside, Calif. 1958.
Fischer, Rudolph, 215 E. Foothill Blvd., La Verne, Calif. 1957.
Fiscus, Clifford H., 841 Sullivan St., Seattle 8, Wash. 1958.
Fish, William R., 2505 Augibi Way, Rancho Cordova, Calif. 1948.
Fisher, Harvey I., Dept. Zoology, Southern Illinois Univ., Carbondale, Ill. 1939.
Fisher, James M., Old Rectory, Ashton, Northampton, England. 1951.
Fitch, Henry S., Univ. Kansas Natural History Reservation, Rt. 3, Box 171, Lawrence, Kan. 1933.
Fitzsimmons, Edward R., 853 Arlington, Berkeley 7, Calif. 1952.
Fleming, Margaret E. B., 1541 Lombardy Rd., Pasadena, Calif. 1957.
Foerster, William X., Rt. 8, Box 417, Tucson, Ariz. 1952.
Follett, W. I., 3501 Broadway, Oakland 11, Calif. 1926 (1949) [L.].
Ford, Mary C., 2360 Scout Rd., Oakland 11, Calif. 1951.
Fordham, Stephen C., Jr., Delmar Game Farm, Delmar, N. Y. 1947.
Foree, Eve, 6260 Castle Dr., Oakland 5, Calif. 1950.
Foree, Lynn, 379 30th St., Oakland 9, Calif. 1950.
Forrest, Bernard A., 1105 San Ysidro Dr., Beverly Hills, Calif. 1957.
Foster, John H., Box 204, Wayne, Pa. 1952.
Foster, Thomas H., Monument Rd., Bennington, Vt. 1951.
Fox, Wade, Jr., Anatomy Dept., School of Medicine, Louisiana State Univ., New Orleans 12, La. 1944.
Frank, Arthur J., 2534 N. Terrace Ave., Milwaukee 11, Wis. 1958.
Fredrickson, Richard W., Zoology Dept., Southern Illinois Univ., Carbondale, Ill. 1948.
French, J. D., Veterans Adm. Hospital, Long Beach 4, Calif. 1958.

French, Norman R., 627 Tendoy Dr., Idaho Falls, Idaho. 1951.
Friedmann, Herbert, U. S. National Museum, Washington, D. C. 1927.
Fritz, Esther C., 102 The Uplands, Berkeley 5, Calif. 1935.
Froelich, Perle D., 229 MacArthur Blvd., Oakland 10, Calif. 1949.
Frothingham, Earl H., 4702 Village Rd., Long Beach 8, Calif. 1955.
Funk, Richard C., 317 Parker St., Fort Collins, Colo. 1955.

G

Gabrielson, Ira N., Rt. 1, Box 349, Oakton, Va. 1919.
Galati, Robert, Rt. 8, Box 336, Tucson, Ariz. 1955.
Galley, John E., 1610 Holloway Ave., Midland, Texas. 1957.
Gallizioli, Steve, 4722 W. Crittenden Lane, Glendale, Ariz. 1951.
Galloway, Leo A., Blue Grass Trailer Park, 4309 Parker Ave., West Palm Beach, Fla. 1957.
Gallup, Fred N., Sr., 142 W. Sixth Ave., Escondido, Calif. 1948.
Gambrill, Mrs. Richard V. N., Vernon Manor, Peapack, N. J. 1956.
Gamero, Antonio, 4207¾ Laurel Canyon Blvd., North Hollywood, Calif. 1949 (1950) [L.].
Gammell, Robert T., Kenmare, N. D. 1945.
Ganier, Albert F., 2112 Woodlawn Dr., Nashville 12, Tenn. 1899.
Gardner, Erle S., Box 67, Temecula, Calif. 1948.
Gardner, Leon L., 3129 Freeman St., San Diego 6, Calif. 1953.
Garland, John J., 117 W. 9th St., Los Angeles 15, Calif. 1957.
Garrett, Lois, 1709 Chestnut St., Kenova, West Va. 1949.
Garrity, Devin A., 682 Forest Ave., Rye, N. Y. 1940.
Gasche, Mary A, 1297 N.E. 103rd St., Miami Shores 38, Fla. 1957.
Gates, Doris, Faculty Apts., Nebraska State Teachers College, Chadron, Nebr. 1955.
Gates, James M., Box 682, Tucson, Ariz. 1957.
Gates, John M., Forestry and Wildlife Management Dept., 424 University Farm Pl., Madison 6, Wis. 1957.
Geiger, Lewyn E., Box 146, Wellborn, Fla. 1958.
Genelly, Richard E., Humboldt State College, Arcata, Calif. 1944.
Gensch, Robert H., 105 Clark Ave., Billings, Mont. 1940.
George, John L., Conservation Division, Vassar College, Poughkeepsie, N. Y. 1951.
Ghiselin, Jon B., 1747 Princeton Ave., Salt Lake City 8, Utah. 1955.
Gibb, Andrew S., 2664 Shasta Rd., Berkeley 8, Calif. 1938.
Gifford, Harold, 3636 Burt St., Omaha 3, Nebr. 1916.
Gift, Robert F., Box 11, Lugoff, S. C. 1951.
Gilchrist, Kennedy W., 2711 Colfax St., Evanston, Ill. 1956.
Gillette, Anne W., 3212 Jackson St., San Francisco 18, Calif. 1955.
Gilliard, E. Thomas, American Museum of Natural History, Central Park West at 79th St., New York 24, N. Y. 1951.
Gilmore, Charley E., J-5 Aggie Villa, Davis, Calif. 1956.
Gines, Hermano, Sociedad de Ciencias Naturales la Salle, Apartado 681, Caracas, Venezuela. 1957.
Giuntoli, Mervin A., 3100 Vistamount Dr., San Jose 24, Calif. 1958.
Glass, Clem C., 4747 Alta Canyada Rd., La Canada, Calif. 1948.
Glick, Bruce, Box 185, State College, Miss. 1957.
Glover, Fred A., 2211 Holmes Run Dr., Falls Church, Va. 1950.
Gloyd, Howard K., Chicago Acad. Sci., 2001 N. Clark St., Chicago 14, Ill. 1937.
Gluck, S. Norris, 305 Beauregard St., Charleston, W. Va. 1958.
Glynn, Gregory C., 65 Partridge St., Albany 6, N. Y. 1956.
Goebel, Herman, 78–52 80th St., Brooklyn 27, N. Y. 1947.
Goelet, Robert G., 425 Park Ave., New York 22, N. Y. 1954.
Goelitz, Walter A., Milford, Pa. 1915 (1920) [L.].
Goethe, C. M., Crocker-Anglo Bank Bldg., 7th and J Sts., Sacramento 14, Calif. 1915.
Goetz, Christian J., 3503 Middleton Ave., Cincinnati 20, Ohio. 1945.
Golden, Robert V., Box 28, Rio Vista, Calif. 1952.
Goldman, Luther C., Box 739, San Benito, Tex. 1949.
Goni, Mary C. J., Box 633, Chico, Calif. 1955.
Goodman, John D., Biology Dept., Univ. Redlands, Redlands, Calif. 1957.
Goodman, Tom V., 732 S. Mansfield Ave., Los Angeles 36, Calif. 1954.
Gordon, Sidney P., Box 1174, State College, N. M. 1948.
Goss, Mildred K., Box 90, Mt. Hamilton Rd., San Jose, Calif. 1950.
Gould, Patrick J., Box 388, Occidental College, Los Angeles 41, Calif. 1951.
Graber, Richard R., 109 W. Franklin St., Urbana, Ill. 1954.
Graf, William, 146 Pleasant Ridge Ave., San Jose, Calif. 1948.
Graham, Alva G., 515 El Centro St., South Pasadena, Calif. 1948.

Graham, Hatch, (Sr.), 204 N. Third Ave., Canton, Ill. 1937.
Graham, Hatch, (Jr.), % U. S. Forest Service, Dinkey Creek, Calif. 1949.
Graham, J. Duncan, Benicia High School, Benicia, Calif. 1937.
Grant, Adele L., 6019 Overhill Dr., Los Angeles 43, Calif. 1946.
Gravem, Nicholas, Jr., 200 Elm Ave., Mill Valley, Calif. 1958.
Gray, Alice G., 6645 Heartwood Dr., Oakland 11, Calif. 1957.
Greeley, Frederick, Illinois Natural History Survey, Natural Resources Bldg., Urbana, Ill. 1948.
Greene, Earle R., 418 S. Holt Ave., Los Angeles 48, Calif. 1948.
Greenewalt, Crawford H., Greenville, Del. 1956 (1956) [L.].
Greenfield, Ray H., 1711 Mahani Loop, Honolulu 17, Hawaii. 1954.
Greenhalgh, Clifton M., Box 326, Murray, Utah. 1939.
Greenway, James C., Jr., Box 26, Wellesley 81, Mass. 1954.
Griffin, Kenneth E., 2506 Glen Green, Hollywood 28, Calif. 1958.
Griffith, Richard M., Jr., 2065 Vallejo St., San Francisco, Calif. 1944.
Grinnell, Hilda W., 3016 Benvenue Ave., Berkeley 5, Calif. 1912 (1921) [L.], (1947) [Honorary].
Grinnell, Lawrence I., 710 Triphammer Rd., Ithaca, N. Y. 1949.
Griscom, Ludlow, Museum of Comparative Zoology, Cambridge, Mass. 1933 (1949) [L.].
Groner, Dorothy E., 4038½ Garden Ave., Los Angeles 39, Calif. 1945 (1957) [L.].
Grootaers, Franz, Prinses Lydialaan 72, Heverlee, Leuven 1, Belgium. 1952.
Gross, Alfred O., 11 Boody St., Brunswick, Maine. 1923.
Grow, Raymond J., Apt. 7, 513 W. 5th Ave., Gary, Ind. 1958.
Gudmundsson, Finnur, Natturugripasafnid, Box 532, Reykjavik, Iceland. 1951.
Guggolz, Jack, 685 Mesa Way, Richmond 9, Calif. 1940.
Guhl, A. M., Zoology Dept., Kansas State College, Manhattan, Kan. 1949.
Gullion, Gordon W., Cloquet Forest Exp. Sta., Cloquet, Minn. 1947.
Gumbart, William B., Box 1936, New Haven 9, Conn. 1952.
Guthrie, Jane K., 3150 Valencia Ave., San Bernardino, Calif. 1957.

H

Hagan, Jack W., 302 S. Sycamore St., Santa Ana, Calif. 1957.
Hagar, Donald C., Jr., Ranger Station, Salyer, Calif. 1955.
Hagar, Mrs. Jack, Rockport Cottages, Box 508, Rockport, Texas. 1945.
Hagenstein, Walter M., Box 12, Medina, Wash. 1957.
Hague, Florence S., 2809 Rivermont Ave., Lynchburg, Va. 1925.
Haig, Emily H., 2216 Federal Ave., Seattle 2, Wash. 1958.
Hailman, Jack P., 4401 Gladwynne Dr., Bethesda 14, Md. 1958.
Haines, Robert L., 54 E. Main St., Moorestown, N. J. 1953.
Hall, Edward M., 7620 S. College Ave., Whittier, Calif. 1937.
Hall, E. Raymond, Museum of Natural History, Univ. Kansas, Lawrence, Kan. 1924.
Hall, George A., Jr., Chemistry Dept., West Virginia Univ., Morgantown, West Va. 1955.
Hall, Joseph G., San Francisco State College, San Francisco 27, Calif. 1954.
Haller, Capt. Karl W., AO–864839, 1st AVNDEPRON, APO 283, New York, N. Y. 1936 (1953) [L.].
Hallman, Roy C., Box 37, St. Andrew Sta., Panama City, Fla. 1945.
Halloran, Arthur F., Wichita Wildlife Refuge, Cache, Okla. 1933.
Hamann, Carl F., Maple Lane, Aurora, Ohio. 1956.
Hamerstrom, Frances, Plainfield, Wis. 1946.
Hamilton, Charles W., 2639 Fenwood Rd., Houston 5, Texas. 1948.
Hamilton, G. Dale, 2550 Murray St., Shreveport 51, La. 1951.
Hamilton, John B., 616 Hot Springs Rd., Santa Barbara, Calif. 1945.
Hamilton, Terrell H., Biological Labs., 16 Divinity Ave., Cambridge 38, Mass. 1953.
Hamilton, Thomas F., 1928 Mandeville Canyon Rd., Los Angeles 49, Calif. 1958.
Hamilton, William J., III, Museum of Vertebrate Zoology, Berkeley 4, Calif. 1954.
Hamlin, John W., 1855 White Oak Dr., Menlo Park, Calif. 1936.
Hammer, U. Theodore, Camrose, Alberta, Canada. 1958.
Hammond, Mary J., 2128 W. 84th St., Los Angeles 47, Calif. 1957.
Hammond, Merrill C., Lower Souris Refuge, Upham, N. D. 1949.
Hamon, J. Hill, Biology Dept., Univ. Florida, Gainesville, Fla. 1958.
Hampe, Irving E., 5559 Ashbourne Rd., Baltimore 27, Md. 1938.
Hand, Ralph L., 415 W. Central, Missoula, Mont. 1927 (1950) [L.].
Hanna, Josephine R., 901 W. Cedar St., El Dorado, Ark. 1956.
Hanna, Wilson C., 712 N. 8th St., Colton, Calif. 1902 (1921) [L.].

Hannum, Robert G., 17600 Lanark, Northridge, Calif. 1958.
Hanson, Hugh, Biol. Sci. Div., Arizona State College, Tempe, Ariz. 1949.
Harding, Margaret R., 526 S. Van Ness Ave., Santa Ana, Calif. 1957.
Harding, William, 526 S. Van Ness Ave., Santa Ana, Calif. 1958.
Hardt, Kathryn L., 207 E. Ave. 41, Los Angeles 31, Calif. 1954.
Hardy, Ross, Long Beach State College, 6101 E. 7th St., Long Beach 4, Calif. 1938.
Hardy, William, Museum of Natural History, Univ. Kansas, Lawrence, Kan. 1953.
Hare, Stanley B., 2505 Canyon Oak Dr., Hollywood 28, Calif. 1957.
Hargrave, Lyndon L., Box 1979, Globe, Ariz. 1931.
Harper, Francis, 115 Ridgway St., Mount Holly, N. J. 1920.
Harrell, Byron E., Zoology Dept., Univ. South Dakota, Vermillion, S. D. 1958.
Harrington, H. Warren, Jr., 19 Holborn St., Milton 86, Mass. 1957.
Harrington, Winthrop W., Jr., 1900 Massachusetts Ave., Lexington 73, Mass. 1958.
Harris, Bruce K., Dept. of Fish & Game, Orchard Park, N. M. 1956.
Harris, William G. F., 147 Hillside St. Milton 86, Mass. 1955.
Harrison, Ed N., 1134 Glendon Ave., Los Angeles 24, Calif. 1931 (1941) [L.].
Hart, John H., 2700 Verona Rd., Kansas City, Mo. 1958.
Hartman, Frank A., Hamilton Hall, Ohio State Univ., Columbus 10, Ohio. 1945.
Hartshorne, James M., 108 Kay St., Ithaca, N.Y. 1957.
Hartung, Esther M., 303 S. Church St., Grass Valley, Calif. 1923.
Harvey, Harry T., 716 Garner Court, Santa Clara, Calif. 1958.
Harwell, C. A., 2630 Hilgard Ave., Berkeley 9, Calif. 1925.
Hastings, Frances S., 3525 Pacific Ave., San Francisco 18, Calif. 1948 (1948) [L.].
Hatch, Grenville, 3127 Alika Ave., Honolulu 17, Hawaii. 1952.
Hatton, Louise M., 200 Calera Canyon Rd., Salinas, Calif. 1932.
Hauselt, Louise H., Davenport, Calif. 1955.
Havemeyer, Henry O., Mountain Side Farm, Mahwah, N. J. 1917.
Haverschmidt, Francois, Box 644, Paramaribo, Surinam, Dutch Guiana. 1946.
Hawbecker, Albert C., Life Science Div., Fresno State College, Fresno 26, Calif. 1936.
Hawes, William D., Box 974, Lancaster, Calif. 1958.
Hawkins, Agnes, Rt. 4, Box 752, Phoenix, Ariz. 1954.
Hawkins, Leslie G., 1390-A 44th St., Los Alamos, N. M. 1941 (1957) [L.].
Hawkins, William R., Co-op. Wildlife Research, Southern Illinois Univ., Carbondale, Ill. 1954.
Hayden, Christine B., 6009 S. Fairfax Ave., Los Angeles 56, Calif. 1950.
Hayward, C. Lynn, Zoology Dept., Brigham Young Univ., Provo, Utah. 1936.
Hebard, Frederick V., 1500 Walnut St. Bldg., Philadelphia 2, Pa. 1945.
Hedine, Melvin A., 1411 W. 69th St., Los Angeles 47, Calif. 1956.
Hefley, Harold M., Panhandle A. & M. College, Goodwell, Okla. 1945.
Helms, Carl W., Hatheway School, Drumlin Farm, South Lincoln, Mass. 1956.
Hemphill, Donald V., Pacific Union College, Box 438, Angwin, Calif. 1937.
Hendricks, Ann R., 720 S. 8th St., San Jose 12, Calif. 1948.
Hendricks, Gene T., 1839 Wyoming Ave., Billings, Mont. 1949.
Henningsen, Lillian K., 124 Cambridge Way, Piedmont 11, Calif. 1949.
Hensley, N. Max, Zoology Dept., Michigan State Univ., East Lansing, Mich. 1952.
Herman, Carlton M., Patuxent Research Refuge, Laurel, Md. 1945.
Herman, Paul A., 290 El Repetto Dr., Monterey Park, Calif. 1958.
Hersey, F. Seymour, Easton, Mass. 1915 (1920) [L.].
Heywood, Philip B., 63 Beechmont St., Worcester, Mass. 1958.
Hickey, Joseph J., 424 Univ. Farm Pl., Madison 6, Wis. 1946.
Hicks, Thomas W., 517 E. Sunshine, Springfield, Mo. 1951 (1952) [L.].
Highley, Elmer E., 1050 Roosevelt St., Monterey, Calif. 1953.
Hildinger, Albert E., 17530 Saticoy St., Van Nuys, Calif. 1952.
Hill, Harold M., 219 Cajon St., Redlands, Calif. 1935.
Hill, Henry G., 465 S. 15th St., San Jose 13, Calif. 1953.
Hill, Herbert O., 11021 Braddock Dr., Culver City, Calif. 1945.
Hill, W. W., Anthropology Dept., Univ. New Mexico, Albuquerque, N. M. 1950.
Hiller, Gladys W., 6436 Via Canada, San Pedro, Calif. 1957.
Hinchman, Richard M., Boston Rd., Groton, Mass. 1951 (1957) [L.].
Hinds, Frank J., Western Michigan Univ., Kalamazoo, Mich. 1942.
Hines, Charles, Jr., 810 Taraval St., San Francisco, Calif. 1956.

Hinshaw, Thomas D., 1827 San Juan Ave., Berkeley 7, Calif. 1931.
Hipple, Byron T., Jr., 114 Chestnut St., Albany 10, N. Y. 1951.
Hock, Raymond J., Arctic Aeromedical Lab., APO 731, Seattle, Wash. 1950.
Hodges, James, 1514 E. High St., Davenport, Iowa. 1948.
Hoffman, Bess M., 1427 S. Van Ness Ave., Los Angeles 19, Calif. 1949.
Hoffmann, Lukas, Tour du Valat, Par le Sambuc, B. D. Rh., France. 1952 (1955) [L.].
Hoffmann, Robert S., Zoology Dept., Montana State Univ., Missoula, Mont. 1957.
Hoffmann, Russell R., R.R. 5, Box 18, Armour Rd., Oconomowoc, Wis. 1954.
Hoffmeister, Linus C., Sr., 504 W. Rips Ave., Lemay 23, Mo. 1956.
Hohfield, Lillian D., 2108 Broadway, San Francisco 15, Calif. 1954.
Holden, Fenn M., Box 428, Grayling, Mich. 1956.
Holdenried, Robert, Liaison Office, U. S. Public Health Service, Fort Dedrick, Md. 1940.
Holgersen, Holger, Stavanger Museum, Stavanger, Norway. 1952.
Holland, Harold M., Box 615, Galesburg, Ill. 1901 (1920) [L.].
Holmes, Richard T., 8669 E. Duarte Ave., San Gabriel, Calif. 1956.
Holt, John R., 112 N. Oakhurst Dr., Beverly Hills, Calif. 1954.
Hood, Leslie I., 73 Hazel St., Mill Valley, Calif. 1956.
Hough, Eleanor S., 1515 Mariposa St., Boulder, Colo. 1947.
Houle, Marcel, 9601 100th St., Edmonton, Alberta, Canada. 1956.
Houston, Stuart, Box 278, Yorkton, Saskatchewan, Canada. 1957.
Howard, Hildegarde, Los Angeles County Museum, Exposition Park, Los Angeles 7, Calif. 1924.
Howell, A. Brazier, Alna, Maine. 1908 (1915) [L.], (1955) [Honorary].
Howell, Thomas R., Zoology Dept., Univ. California, Los Angeles 24, Calif. 1947. (1957) [L.].
Howes, Paul G., Bruce Museum, Bruce Park, Greenwich, Conn. 1951.
Howsley, L. R., 1304 Aetna St., Anaheim, Calif. 1927.
Hoy, Nelson D., Faxon Hollow & Palmer's Mills Rds., R.D. 1, Media, Pa. 1944.
Hubbs, Carl L., Scripps Inst. of Oceanography, La Jolla, Calif. 1945.
Hudson, George E., 303 Side St., Pullman, Wash. 1952.
Huey, Laurence M., Natural History Museum, Balboa Park, San Diego 1, Calif. 1909 (1916) [L.].
Hughes, Gilbert C., III, Botany Div., Florida State Univ., Tallahassee, Fla. 1956.
Hughes, Herbert E., 6648 Tujunga Ave., North Hollywood, Calif. 1953.
Hughes, William H., 8755 S.W. Marine Dr., Vancouver 14, B. C., Canada. 1949.
Humphrey, Olive A., 1080 Fremont Ave., Los Altos, Calif. 1952.
Humphrey, Philip S., Peabody Museum, Yale Univ., New Haven, Conn. 1950.
Hunt, Gerald M., 3911 Alicia Dr., San Diego 7, Calif. 1955.
Hunter, Donnell W., Ricks College, Rexburg, Idaho. 1957.
Huntington, Charles E., Biology Dept., Bowdoin College, Brunswick, Maine. 1951.
Hurd, Paul D., Jr., Entomology & Parasitology Dept., College of Agriculture, Univ. California, Berkeley 4, Calif. 1940.
Hurley, John B., 401 S. 17th Ave., Yakima, Wash. 1921.
Hurlock, Phyllis L., R.D. 1, Coatesville, Pa. 1958.
Hutchinson, Magdeleine C., 2640 Glendessary Lane, Santa Barbara, Calif. 1940.
Hutson, Glen A., 725 Blossom St., Bakersfield, Calif. 1955.
Hyde, A. Sidney, Box 93, Gunnison, Colo. 1939.
Hyde, Mrs. Charles H., 12745 Gravelley Lake Dr., Tacoma 99, Wash. 1951.

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Ingles, Lloyd G., Biology Dept., Fresno State College, Fresno 4, Calif. 1936.
Isaac, Donald E., Zoology Dept., Univ. California, Berkeley 4, Calif. 1948.
Isleib, Peter M., Jones Hollow Rd., Marlborough, Conn. 1958.

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Jackson, Hartley H. T., Rm. 61, U. S. National Museum, Washington 25, D. C. 1921.
Jacobsen, Eric C., Box 233, Ripon, Calif. 1950.
Jaeger, Edmund C., 4465 Sixth St., Riverside, Calif. 1922.
Jahn, Frances F., 10241 Chrysanthemum Lane, Los Angeles 24, Calif. 1948.
James, Douglas A., Zoology Dept., Univ. Arkansas, Fayetteville, Ark. 1947.
Jameson, E. W., Jr., Zoology Dept., Univ. California, Davis, Calif. 1957.
Jefcoat, Arthur W., Inskop P. H., Paynes Creek, Calif. 1937 (1948) [L.].
Jeffrey, Robert G., Rt. 1, Box 809, Stanwood, Wash. 1948.
Jenks, Randolph, 2146 E. Fourth Street, Tucson, Ariz. 1931.

Jessop, Roger W., 5431 W. San Fernando Rd., Glendale, Calif. 1958.
Jeter, Horace H., 3205½ Fairfield Ave., Shreveport, La. 1950 (1951) [L.].
Johnsgard, Paul A., Conservation Dept., Cornell Univ., Ithaca, N. Y. 1955.
Johnson, Alfred W., % Katz, Johnson, S.A.C., Casilla 327, Santiago de Chile. 1951.
Johnson, D. Elmer, Box 334, Dugway, Utah. 1957.
Johnson, Harold N., Box 429, Berkeley 1, Calif. 1955.
Johnson, H. McClure, R.D. 2, Ellis Hollow Rd., Ithaca, N. Y. 1952.
Johnson, John C., Jr., Biology Dept., Kansas State Teachers College, Pittsburg, Kan. 1955.
Johnson, Myrtle E., 4647 55th St., San Diego 15, Calif. 1908.
Johnson, Ned K., Museum of Vertebrate Zoology, Berkeley 4, Calif. 1950.
Johnson, Oscar W., 122 Audubon Way, Pullman, Wash. 1958.
Johnson, Ray R., Jr., 1147 W. Rialto, Fresno 5, Calif. 1950.
Johnson, R. Roy, Rt. 2, Box 269, Glendale, Ariz. 1957.
Johnston, David W., Biology Dept., Mercer Univ., Macon, Ga. 1949.
Johnston, Richard F., Museum of Natural History, Univ. Kansas, Lawrence, Kan. 1947.
Johnston, Verna R., 1812 W. Sonoma Ave., Stockton 4, Calif. 1943.
Jones, Charles S., 555 S. Flower St., Los Angeles 17, Calif. 1957.
Jones, George G., 2930 E. Third St., Tucson, Ariz. 1954.
Jones, George R., 17124 Celtic St., Granada Hills, Calif. 1950.
Jones, John C., 5810 Namakagan Rd., Glen Mar Park, Washington 16, D. C. 1940.
Jones, S. Paul, 509 West Ave. N., Waukesha, Wis. 1929.
Jones, W. Alton, 1 Sutton Pl. South, Apt. 8-A, New York, N.Y. 1957.
Jorae, Irene F., 601 S. Arnold, Mount Pleasant, Mich. 1945.
Jordan, Peter A., 701 Grand Ave., Alameda, Calif. 1956.
Jory, Grace W., 1370 Euclid Ave., Berkeley 8, Calif. 1936.
Jung, Clarence S., 6383 N. Port Washington Rd., Milwaukee 17, Wis. 1956.

K

Kahl, M. Philip, Jr., 122 E. 47th St., Indianapolis 5, Ind. 1954.
Kalmbach, Edwin R., 1601 Mariposa Ave., Boulder, Colo. 1923.
Kaminsky, Muriel, 1213 Robertson Way, Sacramento 18, Calif. 1953.
Karmarkar, Prabhakar G., "Swastik-House," 223/F Maredpalli Rd., Secunderabad, Deccan, India. 1954.
Kashin, Gleb L., T. St., Salt Lake City 3, Utah. 1958.
Kassoy, Irving, 235 S. Fourth St., Columbus, Ohio. 1957.
Keating, Paul J., 1705 S. 41st St., Tacoma 8, Wash. 1952.
Kebbe, Chester E., 5414 N.E. Emerson St., Portland 13, Ore. 1957.
Keeton, Luther F., 80 Eastland Dr., Memphis 11, Tenn. 1944.
Keil, Julius J., 3347 14th St., Long Island City 6, N.Y. 1958.
Kellogg, Louise, 672 15th St., Oakland 12, Calif. 1927 (1927) [L.].
Kellogg, Mildred, Livermore Sanatarium, Livermore, Calif. 1921.
Kelly, Junea W., 1311 Grand St., Alameda, Calif. 1918 (1949) [L.], (1958) [Honorary].
Kemsies, Emerson, Zoology Dept., Univ. Cincinnati, Cincinnati 21, Ohio. 1955.
Kendeigh, S. Charles, Zoology Dept., 201 Vivarium Bldg., Univ. Illinois, Wright & Healey Sts., Champaign, Ill. 1932.
Kenyon, Karl W., Fish & Wildlife Service, Sandpoint NAS, Seattle 15, Wash. 1934 (1950) [L.].
Kerr, John P., 327 Chestnut St., Nutley 10, N.J. 1957.
Kessel, Brina, Box 211, Univ. Alaska, College, Alaska. 1951.
Keyt, Thelma, 657 36th St., Manhattan Beach, Calif. 1958.
Kilham, Lawrence, 7815 Aberdeen Rd., Bethesda 14, Md. 1957.
Killpack, Merlin L., Roosevelt, Utah. 1950.
Kimsey, J. Bruce, 5033 V Street, Sacramento, Calif. 1947.
Kincaid, Edgar B., Jr., 702 Park Pl., Austin 5, Tex. 1949.
King, James R., Exper. Biol. Dept., Univ. Utah, Salt Lake City 12, Utah. 1953.
Kinsey, Eric C., 17 Southwood Ave., Ross, Calif. 1933.
Kinsley, Charles H., 3129 Franklin St., San Francisco, Calif. 1956.
Kirk, Lester K., 19520 Bretton Dr., Detroit 23, Mich. 1955.
Kirkman, Robert W., 9325½ Dearborn Ave., South Gate, Calif. 1958.
Kirscher, William K., 2520 Marconi Ave., Sacramento 21, Calif. 1950.
Kleen, Richard L., Church Neck Rd., St. Michaels, Md. 1957.
Klopfer, Peter H., 639 S. June St., Los Angeles 5, Calif. 1957.
Knorr, Maj. Owen A., 1918 Mariposa, Boulder, Colo. 1950.

Kobayashi, Keisuke, No. 2, I-chome, Shinohara-Kitamachi, Nada-ku (Rokko), Kobe, Honshu, Japan. 1952.

Koford, Carl B., Museum of Vertebrate Zoology, Berkeley 4, Calif. 1939 (1944) [L.].

Koplin, James R., 240½ Fairview Ave., Missoula, Mont. 1958.

Kortright, Francis H., 633 Eastern Ave., Toronto 1, Ontario, Canada. 1945.

Kossack, Charles W., 715 Division St., Barrington, Ill. 1956.

Kraak, W. K., Josef Israelslaan 14, Bussum, Netherlands. 1952.

Kraus, Douglas L., Univ. Rhode Island, Kingston, R.I. 1935.

Krause, Herbert, 1811 S. First Ave., Sioux Falls, S.D. 1958.

Kremers, Edward D., 2125 Mar Vista Ave., Altadena, Calif. 1953.

Kroll, Zerifa S., 608 W. Locust St., Lodi, Calif. 1948.

Krug, Bruce A., Box 405, Chesley, Ontario, Canada. 1945.

Kryder, Emma W., 108 W. Base Line Rd., Claremont, Calif. 1956.

Kunkle, Donald E., Box 121, Port Norris, N.J. 1952.

Kuns, Capt. Merle L., Box 32, Shalimar, Fla. 1955.

Kuroda, Nagamichi, No. 1 Fukuyoshi-cho, Akasaka, Minato-ku, Tokyo, Japan. 1951.

Kyllingstad, Henry C., Arab States Fundamental Education Center, Sirs-el-Layyan, Menoufia, Egypt. 1944.

L

Laestadius, Goran, 939 W. 21st St., Los Angeles 7, Calif. 1956.

La Fave, L. D. 1311 E. Longfellow Ave., Spokane 22, Wash. 1956.

Laing, Hamilton M., Box 82, Comox, British Columbia, Canada. 1926.

Lakata, George D., 1025 Cedar St., Wasco, Calif. 1956.

Lamb, Chester C., 412 Peach St., Compton, Calif. 1899 (1953) [Honorary].

Lamoreux, Rachel E., R.F.D., Box 518, Niles, Calif. 1957.

Lancaster, Douglas A., Museum of Zoology, Louisiana State Univ., Baton Rouge 3, La. 1952.

Landing, James E., 509 E. 10th St., Michigan City, Ind. 1956.

Langlois, Xion R., 805 Paradise Rd., Modesto, Calif. 1958.

Langston, Ronald E., 48 Kirkwood Lane, Greenville, S.C. 1957.

Langstroth, James H., Box 1130, Silver City, N.M. 1922.

Lanyon, Wesley E., American Museum of Natural History, Central Park West at 79th St., New York 24, N.Y. 1955.

Larson, Enid A., Box 2841, Carmel, Calif. 1952.

Laskey, Amelia R., 1521 Graybar Lane, Nashville 12, Tenn. 1933.

Latta, Katherine, 430 W. Moreland Ave., Philadelphia 18, Pa. 1952.

Lawrence, George E., Bakersfield College, 1801 Panorama Dr., Bakersfield, Calif. 1947.

Lawrence, Louise deK., Pisimi Bay, Rutherglen, Ontario, Canada. 1954.

Lawson, Walter J., 68 Chelsea Dr., Durban North, Natal, South Africa. 1956.

Leader, Harold, 2830 Motor Ave., Los Angeles 64, Calif. 1945.

Leavens, Anna C., 1900 Yosemite Rd., Berkeley 7, Calif. 1928.

Lee, Janice T., 1305 Beaver Dam Dr., Raleigh, N.C. 1955.

Lees-Smith, Derek T., Broadmoor Hospital, Crowthorne, Berkshire, England. 1957.

LeFebvre, Eugene A., 3889 Bellaire Ave., White Bear Lake 10, Minn. 1953.

Legg, Ken, 1456 Lindale Court, Eureka, Calif. 1954.

Lehmann, F. Carlos, Apartado Nacional 680, Cali, Colombia, S.A. 1958.

Lehmann, L.Cdr. William G., DC, USN, U.S. Naval Dental Clinic, Long Beach, Calif. 1958.

Leitch, Mary S., 1875 Greenfield Ave., Los Angeles 25, Calif. 1929.

Lengemann, Martha A., 360 Cedar St., Imlay City, Mich. 1951.

Leopold, A. Starker, Museum of Vertebrate Zoology, Berkeley 4, Calif. 1941.

LeSassier, Mrs. John W., 1611 W. Indiana St., Midland, Texas. 1957.

Lester, Vera F., 1215 S. Garfield Ave., Lodi, Calif. 1955.

Levy, Alice K., 2624 Montrose Ave., Montrose, Calif. 1957.

Levy, Seymour H., Rt. 9, Box 960, Tucson, Ariz. 1957.

Lewin, Victor, Museum of Vertebrate Zoology, Berkeley 4, Calif. 1954.

Lewis, Harrison F., West Middle Sable, Shalbourne Co., Nova Scotia, Canada. 1946.

Lewis, Mary, 925 Dauphine, New Orleans 16, La. 1957.

Lewis, Alice H., 220 N. Berendo St., Los Angeles 27, Calif. 1950.

Lewis, William O., Box 22, Ivy, Va. 1956.

Lieftinck, John E., % Goodyear, S.A., Luxembourg City, Luxembourg. 1947.

Ligon, J. Stokley, Box 950, Carlsbad, N.M. 1914.

Lincoln, Frederick C., Fish & Wildlife Service, Washington 25, D.C. 1922.

Lindau, S. Paul, 108 N. Harvard Blvd., Los Angeles 4, Calif. 1949.

Linford, Gene H., Zoology Dept., Utah State Univ., Logan, Utah. 1955.
Linford, James B., 538 Fairbanks Ave., Oakland 10, Calif. 1949.
Linsdale, Jean M., Hastings Natural History Reservation, Jamesburg Rt., Carmel Valley, Calif. 1926 (1956) [Honorary].
Linsley, Richard H., 305 Palm Ave., Balboa Sta., Newport Beach, Calif. 1952.
Linton, M. Albert, 315 E. Oak Ave., Moorestown, N.J. 1947.
Little, Luther, Casa Lomita, Rt. 1, Box 21-E, Littlerock, Calif. 1913 (1920) [L.].
Livermore, John W., Box 77, West Redding, Conn. 1940.
Lloyd, Hoyes, 582 Mariposa Ave., Rockcliffe Park, Ottawa, Ontario, Canada. 1923.
Locke, Louis, 1607 W. Tansill, Carlsbad, N.M. 1948.
Lockwood, Robert M., 2217 Glenwood Lane, Denton, Tex. 1948.
Loetscher, Frederick W., Jr., 507 W. Main St., Danville, Ky. 1950.
Long, Roberta J., 45 Clarendon Ave., San Francisco 14, Calif. 1951.
Longhurst, William M., Box 308, Hopland, Calif. 1939.
Loring, George G., Bridge St., Manchester, Mass. 1951.
Low, Jessop B., Utah State Univ., Logan, Utah. 1958.
Low, Seth H., R.D. 2, Gaithersburg, Md. 1948 (1951) [L.]
Lowe, Charles H., Jr., Zoology Dept., Univ. Arizona, Tucson, Ariz. 1950.
Lowery, George H., Jr., Museum of Zoology, Louisiana State Univ., Baton Rouge 3, La. 1938.
Lukens, William W., Jr., 444 Upper Gulph Rd., Radnor, Pa. 1947.
Lunk, William A., 1807 Sunrise St., Ann Arbor, Mich. 1948.
Luwe, William R., 309 State St., Mankato, Minn. 1956.

M

MacArthur, Robert H., R.F.D. 1, Newfane, Vt. 1956.
MacDonald, Kenneth F., 2912 S.E. 75th Ave., Portland 6, Ore. 1947.
MacFaden, John R., 417 S. Hill St., Los Angeles 13, Calif. 1958.
MacGregor, Wallace G., Jr., 4433 E. Simpson Ave., Fresno 3, Calif. 1947.
Machris, Maurice A., 550 S. Flower St., Los Angeles 17, Calif. 1949 (1953) [L.].
MacKay, Ronald H., Canadian Wildlife Service, Forestry & Geology Bldg., Univ. of British Columbia, Vancouver, B.C., Canada. 1952.
MacKenzie, Locke, 829 Park Ave., New York 21, N.Y. 1947.
Maher, William J., Museum of Vertebrate Zoology, Berkeley 4, Calif. 1953.
Mair, Eileen L., 2901 Calderwood Lane, Apt. 10, Sacramento 21, Calif. 1952.
Mall, Rolf E., 753 Johnson St., Red Bluff, Calif. 1948.
Mallette, Robert D., 1138 Keifer St., Marysville, Calif. 1948.
Malott, James P., 4911 Eppes St., Houston 21 Texas. 1956.
Maly, Lucille M., 3899 E. 176th St., Cleveland 28, Ohio. 1948.
Mangels, Frederick P., 708 Farmers Ave., Bellmore, L.I., N.Y. 1954.
Mann, Lila M., 7537 E. Glencliff Dr., Downey, Calif. 1951.
Manning, Thomas H., 37 Linden Terr., Ottawa 1, Ontario, Canada. 1951.
Mapes, Russell B., 4835 Berryman Ave., Culver City, Calif. 1953.
Marfield, George R., 1820 S. Olive Ave., Alhambra, Calif. 1945.
Margadant, Ted, 2609 Manning Ave., Los Angeles 64, Calif. 1957.
Margolin, Abe S., 5631 N. 13th Dr., Phoenix, Ariz. 1948.
Marionneaux, Alice S., Central Romana Corp., La Romana, Dominican Republic. 1947.
Marks, Jack L., Portland Zoo, 400 S.W. Kingston Ave., Portland 1, Ore. 1951.
Marqua, David G., 421 St. Louis Ave., Long Beach 14, Calif. 1957.
Marsh, Francis E., First Nat. Bank Bldg., McMinnville, Ore. 1957.
Marshall, David B., Malhauer National Wildlife Refuge, Burns, Ore. 1946.
Marshall, Joe T., Jr., Zoology Dept., Univ. Arizona, Tucson 25, Ariz. 1936.
Marshall, Perry R. F., Denman Island, British Columbia, Canada. 1948.
Martin del Campo, Rafael, Instituto de Biologia, Ciudad Universitaria, Mexico 20, D.F., Mex. 1948.
Matchem, Charles O., 2225 Robles Ave., San Marino, Calif. 1958.
Mathews, Frank P., Rt. 6, Box 308, Olympia, Wash. 1950.
Matsui, Seima, % Kamo Norin Koto-Gakko, Jyojo, Kamo-Shi, Niigata-Ken, Japan. 1957.
Mayfield, Harold F., R.F.D., River Rd., Waterville, Ohio. 1947.
Mayhew, Wilbur W., 6727 Mt. Whitney Ave., Riverside, Calif. 1946.
Mayne, Robert G., 312 N. Commonwealth Ave., Los Angeles 4, Calif. 1957.
Mayr, Ernst, 21-A Washington Ave., Cambridge 40, Mass. 1933.
Mazzeo, Rosario, 114 The Fenway, Boston 15, Mass. 1946.

McAlpin, David H., Box 670, Princeton, N.J. 1956 (1957) [L.].

McAtee, W. L., 3 Davie Circle, Chapel Hill, N.C. 1907.

McBride, Charlotte A., 25441 Crescent Lane, Los Altos Hills, Calif. 1954.

McCabe, Robert A., 424 University Farm Pl., Madison 6, Wis. 1947.

McCammon, James H., 2208 Rockbridge, Sacramento, Calif. 1958.

McCaskie, Reginald G., Box 241, Tahoe City, Calif. 1957.

McChesney, Donald S., 405 Piercefield Dr., Syracuse 9, N.Y. 1956.

McClure, H. Elliott, U.S. Army Med. Research Unit, Inst. Med. Res., Kuala Lumpur, Malaya. 1947.

McConoughey, Frank P., 1547 Northland Ave., Lakewood 7, Ohio. 1954.

McCoy, Edward D., Santa Maria Inn, Santa Maria, Calif. 1951.

McDavid, G. M., 1016 W. Oak St., El Dorado, Ark. 1956.

McDonald, Mrs. James R., 1042 Chestnut St. San Francisco, Calif. 1927 (1927) [L.]

McElroy, Mildred, 404 Gladstone Blvd., Shreveport, La. 1948.

McFadyen, J. Ross, 1203 Emerson St., Denver 18, Colo. 1949.

McHenry, Douglas B., 168 W. Third North, Logan, Utah. 1958.

McKeever, Christopher K., Box 146, Old Country Rd., Water Mill, N.Y. 1954.

McKinney, David F., Delta Waterfowl Research Station, Delta, Manitoba, Canada. 1955.

McKnight, Edwin T., 5038 Park Pl., Washington 16, D.C. 1936.

McLaughlin, Charles A., Los Angeles County Museum, Exposition Park, Los Angeles 7, Calif. 1957.

McLean, Donald D., 2455 Cottle Ave., San Jose 25, Calif. 1916.

McMillan, Eben, Cholame, Calif. 1946.

McMillan, Ian I., Box 63, Shandon, Calif. 1945.

McQuesten, Leavitt M., 120 Otis St., Santa Cruz, Calif. 1951.

Medina, Don R., Museum of Vertebrate Zoology, Berkeley 4, Calif. 1954.

Meinhardt, Hans, 57 Taylor St., San Francisco 2, Calif. 1948.

Mellinger, E. O., Savannah National Wildlife Refuge, Box 4008, Port Wentworth, Ga. 1940.

Mellor, Norman H., Idyllwild School of Conservation & Nat. Sci., 817-B S. Main St., Corona, Calif. 1952.

Melstrom, Donald S., 5413 Calle de Arboles, Torrance, Calif. 1956.

Meng, Heinz K., State Teachers College, New Paltz, N.Y. 1945 (1950) [L.].

Menninger, Phil B., 1724 Collins Ave., Topeka, Kan. 1948.

Merkel, Nancy M., Borrego Springs, Calif. 1950.

Mers, William H., 1659 Marlowe Ave., Cincinnati 24, Ohio. 1951.

Metcalf, Homer N., Horticulture Dept., Montana State College, Bozeman, Mont. 1945.

Mewaldt, L. Richard, Nat. Sci. Div., San Jose State College, San Jose 14, Calif. 1947.

Meyerholz, Rheinier I., 10781 N. Saratoga Rd., Cupertino, Calif. 1956.

Meyerriecks, Andrew J., Box 155, South Lincoln, Mass. 1948.

Michener, Josephine R., 418 No. Hudson Ave., Pasadena 4, Calif. 1934 (1942) [Honorary].

Miles, Merriam L., Box 1500, Greenville, S.C. 1954.

Miller, Alden H., Museum of Vertebrate Zoology, Berkeley 4, Calif. 1923 (1949) [L.], (1957) [Honorary].

Miller, August W., 1476 Youngs Lane, Yuba City, Calif. 1950.

Miller, Clark, Inwood, West Va. 1956.

Miller, Dale, 14826 S. Lime Ave., Compton 2, Calif. 1957.

Miller, Douglas S., 122 Lawrence Ave. E., Toronto, Ontario, Canada. 1953 (1953) [L.]

Miller, Frederick W., 4017 Rawlins St., Dallas 19, Texas. 1955.

Miller, Grace M., Box 103, Inverness, Marin Co., Calif. 1958.

Miller, John L., 3310 W. Washington Blvd., Los Angeles 18, Calif. 1953.

Miller, Lotus S., Zoology Dept., Univ. Calif., Davis, Calif. 1956.

Miller, Loye H., 15475 Albright St., Pacific Palisades, Calif. 1905. (1936) [Honorary], (1950) [L.].

Miller, Palmer D., 1063 N. Fulton St., Fresno 4, Calif. 1957.

Miller, Ralph H., 274 E. Ninth St., Upland, Calif. 1942.

Miller, Robert C., California Academy of Sciences, Golden Gate Park, San Francisco 18, Calif. 1921.

Miller, Thomas, 394 Grenola St., Pacific Palisades, Calif. 1937.

Milnes, Hattie K., 331 E. Gowen Ave., Mount Airy, Philadelphia 19, Pa. 1953.

Milwain, Margaret J., 6926 Sayre Dr., Oakland 11, Calif. 1948.

Miskimen, Mildred, Zoology Dept., Douglass College, Rutgers Univ., New Brunswick, N.J. 1953.

Mitchell, Margaret K., 150 Balmoral Ave., Apt. 301, Toronto 7, Ontario, Canada. 1949.

Moeller, B. A., 489 Prospect Terr., Pasadena 3, Calif. 1935.

Monk, Harry C., 406 Avoca St., Nashville 5, Tenn. 1925.

Monroe, Burt L., Sr., Ridge Rd., Anchorage, Ky. 1947.
Monroe, Lt. J.G., Burt L., Jr., % Francis M. Weston, 2006 E. Jordan St., Pensacola, Fla. 1954.
Monroe, Morgan, 2802 N. 21st St., Phoenix, Ariz. 1955.
Monson, Gale W., Box 1032, Yuma, Ariz. 1936.
Montgomery, Vester, 1302 N. Pennsylvania Ave., Roswell, N.M. 1952.
Moody, Marjorie J., 1380 Veterans Ave., Apt. 1, Los Angeles 24, Calif. 1946.
Moody, Nina, 547 13th St., Richmond 5, Calif. 1955.
Moody, R. Wayne, 1169 Colorado Blvd., Denver 6, Colo. 1958.
Moore, Donald W., 211-A Mitscher Rd., China Lake, Calif. 1949.
Moore, Margaret R., 335 W. Lexington St., Danville, Ky. 1951.
Moore, Milton C., 1757 Shawnee Rd. S.E., Massillon, Ohio. 1955.
Moore, Robert T., 582 Meadow Grove Pl., Pasadena 3, Calif. 1911 (1947) [L.], (1950) [Honorary].
Moore, William H., 919 Grace St., Bakersfield, Calif. 1958.
Moran, Robert B., 170 E. Orange Grove, Pasadena 3, Calif. 1897.
Morejohn, G. Victor, Jr., Zoology Dept., Univ. California, Davis, Calif. 1946.
Morel, Elton L., 2637 E. Glenoaks Blvd., Glendale 6, Calif. 1955.
Moreno, Abelardo, Museo Poey, Catedra U, Escuela de Ciencias, Universidad de la Habana, La Habana, Cuba. 1953.
Morse, Douglass H., Star Route, Lisbon, Maine. 1957.
Morton, David E., 633 N. Chalburn St., West Covina, Calif. 1955.
Moses, Leon, 19 E. 74th St., New York 21, N.Y. 1954 (1956) [L.].
Mossman, Archie S., Zoology Dept., Univ. Wyoming, Laramie, Wyo. 1950.
Mount, Joseph F., 10770½ Strathmore Dr., Los Angeles 24, Calif. 1957.
Mowbray, M. Vincent, 313 Hill Dr., Grand Junction, Colo. 1937.
Mudge, Edmund W., Jr., 5926 Averill Way, Preston Hollow, Dallas 5, Texas. 1945.
Mueller, Helmut C., Zoology Dept., Univ. Wisconsin, Madison 6, Wis. 1950.
Muir, Allister, Royal Bank of Canada, 1682 Marine Dr., West Vancouver, B.C., Canada. 1956.
Mulaik, Stanley B., Zoology Dept., Univ. Utah, Salt Lake City 12, Utah. 1958.
Munger, Osgood H., 555 Mission St., Salem, Ore. 1951.
Munro, J. A., Okanagan Landing, British Columbia, Canada. 1914.
Murie, Adolph, Moose, Wyo. 1935.
Murie, Olaus J., Moose, Wyo. 1913.
Murphy, Grace E. Barstow, Briarlea, Old Field, Setauket, L.I., N.Y. 1952.
Murphy, Joseph R., 625 S. 51st St., Lincoln 10, Nebr. 1951.
Murphy, William B., 522 Hillgreen Dr., Beverly Hills, Calif. 1952.
Murray, Lucy H., Regina College, Regina, Saskatchewan, Canada. 1956.

N

Neff, Johnson A., Wildlife Research Lab., Bldg. 45, Federal Center, Denver 2, Colo. 1920.
Neil, Richard W., Rt. 2, Box 305-AA, St. Helena, Calif. 1942.
Neldam, Rosalia, 304 La Espiral, Orinda, Calif. 1949.
Nelson, Edith T., 650 Blair Ave., Piedmont 11, Calif. 1947.
Nelson, Theodora, 315 E. 68th St., New York 21, N.Y. 1940.
Newman, Robert J., 655 Ursuline Dr., Baton Rouge 8, La. 1952.
Newton, Maj. Earl T., Jr., 5145 Swope Parkway, Kansas City 30, Mo. 1942.
Nice, Margaret M., 5725 Harper Ave., Chicago 37, Ill. 1921 (1950) [L.].
Nichols, Charles K., 212 Hamilton Rd., Ridgewood, N.J. 1936.
Nichols, John T., American Museum of Natural History, Central Park West at 79th St., New York 24, N.Y. 1909.
Nichols, Mary J., Rt. 5, Box 234, Tucson, Ariz. 1939.
Nichols, Walter F., 2437 Lambert Dr., Pasadena 8, Calif. 1938.
Nicholson, Donald J., 1224 Palmer St., Orlando, Fla. 1911.
Nickell, Walter P., Cranbrook Inst. Science, Bloomfield Hills, Mich. 1947.
Nicoullaud, Jean, 48 Rue Descartes, Chinon, France. 1953.
Niedrach, Robert J., R.R. 3, Box 116-A, Littleton, Colo. 1957.
Nielsen, Beatrice W., Rt. 1, Box 808, Kauffman Ave., Red Bluff, Calif. 1942.
Noack, Harry R., 309 MacArthur Blvd., Oakland 10, Calif. 1901.
Nolan, Val, Jr., School of Law, Indiana Univ., Bloomington, Ind. 1956.
Norman, Edward, 181 Stage Harbor Rd., Chatham, Mass. 1951.
Norris, Robert A., 1918 Hahn Ave., Aiken, S.C. 1949.
Northern, James R., Los Angeles County Museum, Exposition Park, Los Angeles 7, Calif. 1958.
Novaes, Fernando C., Rua Toneleros 186, Apartado 303, Copacabana, Rio de Janeiro, D.F., Brazil. 1951.

O

Oakeson, Barbara N., 2941 State St., Apt. 2, Santa Barbara, Calif. 1930.
Oberholser, Harry C., 2933 Berkshire Rd., Cleveland Hts., Cleveland 18, Ohio. 1904.
O'Callagham, T. C., Maromaku R.D., Bay of Islands, Northland, New Zealand. 1955.
Odlum, Gordon C., Race Rocks Lightstation, % Pilotage Authority, 200 Dallas Rd., Victoria, British Columbia, Canada. 1948.
Odom, Mrs. Edgar R., Box 458, Orange, Texas. 1951.
Oeming, Albert F., Sub. P.O. 23, Edmonton, Alberta, Canada. 1956.
Ogilvie, Philip W., Museum of Natural History, Univ. Kansas, Lawrence, Kan. 1956.
O'Keefe, Charlotte L., 2838 Buena Vista Way, Berkeley 8, Calif. 1955.
Olson, Andrew C., Jr., San Diego State College, B-173, San Diego 15, Calif. 1940.
Olson, Leo B., 835 S. First St., DeKalb, Ill. 1951.
Olson, Madge, 25 E. 9th Ave., Apt. 12, Denver 12, Colo. 1957.
Ondrias, John C., Zoology Dept., Univ. Athens, Athens, Greece. 1957.
O'Neil, Norah S., 1311 Bonham St., Commerce, Texas. 1951.
Orians, Gordon H., Museum of Vertebrate Zoology, Berkeley 4, Calif. 1956.
Orr, Mary T., Box 183, Reserve, N.M. 1954.
Orr, Robert T., California Acad. Sci., Golden Gate Park, San Francisco 18, Calif. 1931.
Owen, W. Plass, Box 516, Chula Vista, Calif. 1957.
Owre, Oscar T., Jr., 3916 Irvington Ave., Coconut Grove, Miami 33, Fla. 1937.

P

Pace, Irene D., 627 S. Windsor Blvd., Los Angeles 5, Calif. 1957.
Palmella, Duke of, 140 Rua da Escola Politecnica, Lisbon, Portugal. 1954.
Palmer, C. Mortimer, Jr., Box 414, Tombstone, Ariz. 1952.
Palmer, Fletcher G., 212 W. Primrose St., Placentia, Calif. 1942.
Palmer, Ralph S., New York State Museum, State Education Bldg., Albany 1, N.Y. 1951.
Paludan, Knud, Vildtbiologisk Station, Kalo, Ronde, Denmark. 1954.
Park, Charles F., Jr., 1431 Arcadia Pl., Palo Alto, Calif. 1947.
Parker, Clarence J., 821 N. Garfield Ave., Alhambra, Calif. 1938.
Parkes, Kenneth C., Carnegie Museum, Pittsburgh 13, Pa. 1947.
Parmalee, Paul W., Illinois State Museum, Springfield, Ill. 1951.
Parmeter, Benjamin D., Armstrong Woods Rd., Guerneville, Calif. 1956.
Parratt, Lloyd P., 500 W. 14th St., Upland, Calif. 1956.
Parrish, Chris, 5615 Madra Ave., San Diego 20, Calif. 1957.
Parsons, Robert P., Rt. 3, Box 310, Carmel, Calif. 1951.
Partridge, William H., Belgrano 363, Caseros, B.A., Argentina. 1956.
Patten, Harvey L., 1310 Thomas Ave. North, Minneapolis, Minn. 1957.
Patterson, Elizabeth C., 15862 La Forge St., Whittier, Calif. 1955.
Payne, Donald E., Rt. 4, Box 504, Hood River, Ore. 1946.
Payne, Everitt V., 18152 LeMay St., Reseda, Calif. 1951.
Paynter, Raymond A., Jr., Museum of Comparative Zoology, Harvard Univ., Cambridge 38, Mass. 1946.
Pearse, Theed, Comox, Vancouver Island, British Columbia, Canada. 1927.
Pearson, Oliver P., Museum of Vertebrate Zoology, Berkeley 4, Calif. 1948.
Pemberton, J. R., 714 W. Olympic Blvd., Los Angeles 15, Calif. 1901 (1928) [L.], (1949) [Honorary].
Penberthy, Alan H., 21 Rutland Rd., Freeport, N.Y. 1957.
Penick, A. J., 6344 Brompton, Houston 5, Texas. 1957.
Pequegnat, Willis E., Zoology Dept., Pomona College, Claremont, Calif. 1937.
Perley, Mrs. Lyman O., 520 S. 31st St., Apt. 8, Omaha, Nebr. 1927 (1927) [L.].
Peterson, Peter C., Jr., 620 E. 30th St., Davenport, Iowa. 1953.
Peterson, Harold G., 3548 65th Ave., Oakland 5, Calif. 1957.
Peterson, Roger T., Neck Road, Old Lyme, Conn. 1939.
Pettingill, Olin S., Jr., Wayne, Maine. 1934 (1948) [L.].
Peyton, Laurence G., R.D. 2, Box 261, Fillmore, Calif. 1909 (1922) [L.].
Peyton, Leonard J., Arctic Health Research Center, Box 960, Anchorage, Alaska. 1958.
Peyton, Sidney B., R.D. 2, 260 Fillmore, Calif. 1913 (1922) [L.].
Phelps, James H., Jr., 717 S. 4th Ave., Pocatello, Idaho. 1944.
Phelps, William H., Sr., Apartado 2009, Caracas, Venezuela. 1941.
Phelps, William H., Jr., Apartado 2009, Caracas, Venezuela. 1951.
Philbrick, Hazel B., 5090 Washington St., St. Louis 8, Mo. 1958.
Phillips, Allan R., Box 1979, Globe, Ariz. 1933 (1948) [L.].
Phillips, Priscilla, 1010 Monte Dr., Santa Barbara, Calif. 1957.

Phillips, William B., 166 E. 96th St., New York 28, N.Y. 1951.
Pickering, Robert, 66 Menno St., Waterloo, Ontario, Canada. 1952.
Pickett, Edwin R., 3940 N. St., Sacramento 16, Calif. 1953.
Pierce, Fred J., Winthrop, Iowa. 1948.
Pierce, Robert A., 1256 17th St., West Des Moines, Iowa. 1945.
Pinkas, Leo, 3127 Volk Ave., Long Beach 8, Calif. 1953.
Pitelka, Frank A., Museum of Vertebrate Zoology, Berkeley 4, Calif. 1940.
Piternick, George, 1174 Cragmont Ave., Berkeley 8, Calif. 1951.
Plath, Karl, 114 S. East Ave., Oak Park, Ill. 1954.
Plymell, Florence E., 1241 Bush St., San Francisco 9, Calif. 1950.
Poole, Cecil A., 1764 Topeka Ave., San Jose 26, Calif. 1941.
Porter, Eliot F., Rt. 1, Box 33, Santa Fe., N.M. 1946.
Porter, Richard D., Big Bend National Park, Texas. 1949.
Pough, Richard H., 33 Highbrook Ave., Pelham 65, N.Y. 1926.
Poyser, Florence E., Box 1, Boulder City, Nev. 1952.
Pratt, Helen S., 2451 Ridge View Ave., Los Angeles 41, Calif. 1940.
Pray, Russell H., 662 Santa Rosa Ave., Berkeley 7, Calif. 1948.
Presnall, Clifford C., 4923 Earlston Dr., Washington 16, D.C. 1931.
Preston, Frank W., Box 149, Butler, Pa. 1957.
Price, John B., 532 Alvarado Row, Stanford, Calif. 1926.
Price, Ruth M., 5255 Glasgow Way, Los Angeles 45, Calif. 1942.
Pringle, Cornelia C., 1816 Vallejo St., San Francisco, Calif. 1915 (1921) [L.].
Prosser, Capt. Albert L., Box H, Springvale, Maine. 1955.
Pulich, Warren M., 2021 Rosebud Dr., Irving, Texas. 1941.
Purinton, James G., 1294 Hanchett Ave., San Jose, Calif. 1934.
Pursell, William M., 511 Neilson St., Berkeley 7, Calif. 1926.
Putman, William L., Dom. Entomological Lab., Vineland Sta., Ontario, Canada. 1947.
Pyburn, William F., 1400 W. Lovers Lane, Arlington, Texas. 1955.
Pyle, Robert L., 6117 Radford Dr., Seattle 15, Wash. 1950.

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Quast, Rosemary, 1035-A Fifth St., Santa Monica, Calif. 1956.
Quay, Thomas L., Zoology Dept., North Carolina State College, Raleigh, N.C. 1957.
Quay, Wilbur B., Zoology Dept., Univ. California, Berkeley 4, Calif. 1947.
Quigley, Raymond, Jr., 14008 Lanning Dr., Whittier, Calif. 1937.

R

Rabor, Dioscoro S., Silliman Univ., Dumaguete City, Negros Oriental, Philippines. 1955.
Ragan, Calvin, Box 7, Bell, Calif. 1952.
Raitt, Ralph J., Jr., Museum Vertebrate Zoology, Berkeley 4, Calif. 1954.
Ralph, C. John, 1043 Merced Ave., Berkeley 7, Calif. 1957.
Ramsey, D. Hiden, 58 Woodlawn Rd., Asheville, N.C. 1956.
Rand, Austin L., Chicago Natural History Museum, Roosevelt Rd. and Lake Shore Dr., Chicago 5, Ill. 1955.
Randall, Clarence B., 38 S. Dearborn St., Chicago 3, Ill. 1951.
Randolph, Evan, 1416 Seminole St., Philadelphia 2, Pa. 1951.
Ransom, Webster H., 9676 Evergreen Dr., Vuecrest, Bellevue, Wash. 1921.
Rapp, William F., Jr., 430 Ivy Ave., Crete, Nebr. 1941.
Ray, Mrs. Milton S., 64 Spencer Lane, Atherton, Calif. 1948.
Raymond, Francis, Box 1071, Laguna Beach, Calif. 1950.
Read, Bayard W., Upper Dogwood Lane, Rye, N.Y. 1949.
Rechnitzer, Andreas B., U.S. Navy Electronics Lab. (2235), San Diego 52, Calif. 1954.
Reed, Richard H., Box 424, Coolidge, Ariz. 1947.
Reeder, William G., Zoology Dept., Univ. Wisconsin, Madison 6, Wis. 1946.
Reeves, Henry M., Box 407, Aberdeen, S.D. 1957.
Rehfisch, Carol, 1585 Beach St., Apt. 304, San Francisco 23, Calif. 1951.
Reichert, Elsa, 14 W. First St., Mount Vernon 15, N.Y. 1950.
Reinelt, Mrs. Frank, 344 Arroyo Seco, Santa Cruz, Calif. 1956.
Renetzky, Andrew, 1008 Palm St., San Luis Obispo, Calif. 1949.
Renny, Ronald B., 2030 Westlake Ave., Seattle 1, Wash. 1956.
Rett, E. Z., Museum of Natural History, 2559 Puesta del Sol Rd., Santa Barbara, Calif. 1937.
Reuther, Ronald T., 1329 S. School St., Lodi, Calif. 1946.
Reynolds, Edgar W., 615 Louisiana Ave., Cumberland, Md. 1956.
Reynolds, Harold C., Museum Vertebrate Zoology, Berkeley 4, Calif. 1946.
Reynolds, T. Eric, 140 Estates Dr., Piedmont 11, Calif. 1934.
Rice, Dale W., U.S. Fish & Wildlife Service, % Navy 3080, Box 1, FPO, San Francisco, Calif. 1958.

Rich, C. Selwyn, 114 Champion Pl., Alhambra, Calif. 1939.
Richardson, Carl, Trail, Ore. 1925.
Richardson, Charles H., 813 Ashley Rd., Santa Barbara, Calif. 1957.
Richardson, Ethel E., 887 Indian Rock Ave., Berkeley 7, Calif. 1941.
Richardson, Frank, Zoology Dept., Univ. Washington, Seattle 5, Wash. 1935.
Richmond, Stanley M., 331 Medical Center Bldg., Eugene, Ore. 1951.
Richter, Carl H., 703 Main St., Oconto, Wis. 1948.
Richter, G. William, Box 365, Canfield, Ohio. 1955.
Rigby, Mrs. Douglas, Sedona, Ariz. 1951.
Ripley, S. Dillon, Peabody Museum, New Haven 11, Conn. 1954.
Rising, James D., 4406 Sunrise Dr., Kansas City 23, Mo. 1955.
Robbins, Chandler S., R.D. 1, Box 323-A, Brooklyn Bridge Rd., Laurel, Md. 1954.
Roberts, Bert, 6951 33rd St. N.W., Washington 15, D.C. 1947.
Roberts, Frances F., 1134 Glendon Ave., Los Angeles 24, Calif. 1942 (1949) [L].
Robertson, Frank D., 133 S. 12th St., San Jose 12, Calif. 1956.
Robertson, John McB., 623 Sunset Dr., Paradise, Calif. 1913 (1949) [Honorary].
Robertson, William B., Jr., Rt. 2, Box 83-C, Homestead, Fla. 1955.
Robinson, Roy G., Jr., 1320 W. 29th St., Los Angeles 7, Calif. 1952.
Rockefeller, William A., Rm. 1301, Lincoln Bldg., 60 E. 42nd St., New York 17, N.Y. 1952.
Rodgers, Thomas L., Chico State College, Chico, Calif. 1957.
Roesler, M. Stuart, June Road, Cos Cob, Conn. 1949.
Roest, Aryan I., Biol. Sci. Dept., State Polytechnic College, San Luis Obispo, Calif. 1947.
Rogers, Caroline W., 1029 Vallejo St., Santa Rosa, Calif. 1938.
Rooney, James P., Jr., 1514 S. 12th Ave., Yakima, Wash. 1948.
Root, Oscar M., Brooks School, North Andover, Mass. 1958.
Rosche, Richard C., Zoology Dept., Marshall College, Huntington 1, W. Va. 1956.
Rosin, Axel G., 691 W. 247th St., Riverdale, New York 71, N.Y. 1957.
Ross, Aaron B., 3417 Fillmore Ave., Ogden, Utah. 1947.
Ross, C. Chandler, 710 Wolcott Dr., "Cherokee," Philadelphia 18, Pa. 1948.
Ross, Hollis T., 29 S. Second St., Lewisburg, Pa. 1936.
Ross, Mary R. S., 455 E. Ridge St., Marquette, Mich. 1956 (1957) [L.].
Ross, Roland C., 1820 Bushnell Ave., South Pasadena, Calif. 1920.
Ross, R. Dudley, 16510 Las Casas Pl., Pacific Palisades, Calif. 1955.
Roth, Edgar S., 7024 Melrose Ave., Los Angeles 38, Calif. 1949.
Rowinski, Ludwig J., Box 86, College, Alaska. 1948.
Rowley, J. Stuart, 2716 Holland St., San Mateo, Calif. 1928.
Royall, Willis C., Jr., 219 W. College St., Nacogdoches, Texas. 1958.
Rubey, William W., 5216 Westwood Dr., Washington 16, DC. 1949.
Rudd, Clayton G., 315 Medical Arts Bldg., Minneapolis 2, Minn. 1945.
Rudd, Robert L., Zoology Dept., Univ. California, Davis, Calif. 1939.
Russell, Christopher R., 7826 Arnett, Downey, Calif. 1957.
Russell, Richard W., Naturalist Sec., National Capital Parks, Washington 25, D.C. 1954 (1958) [L.].
Russell, Stephen M., Museum of Zoology, Louisiana State Univ., Baton Rouge 3, La. 1957.
Russell, Ward C., Museum of Vertebrate Zoology, Berkeley 4, Calif. 1930.
Rycraft, Thomas M., Box 401, Elk Grove, Calif. 1950.
Ryder, Ronald A., College of Forestry, Colorado State Univ., Fort Collins, Colo. 1949.
Ryser, Fred A., Jr., Biology Dept., Univ. Nevada, Reno, Nev. 1954.

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Sabin, Walton B., 652 Kenwood Ave., Slingerlands, N.Y. 1954.
Sage, Bryan L., Khanaqin Oil Co., Alwand Refinery, Khanaqin, Iraq. 1958.
Salt, George W., Zoology Dept., Univ. California, Davis, Calif. 1947.
Salter, Robert L., 512 Michael St., Boise, Idaho. 1955.
Saltzer, Helene B., 335 W. Lincoln Ave., Nampa, Idaho. 1957.
Sampson, Walter B., 1005 N. San Joaquin St., Stockton 3, Calif. 1894.
Sams, James R., Natural History Museum, Balboa Park, San Diego 1, Calif. 1944.
Sanchez-Mejorada, Carlos, Jr., Montes Urales 632, Lomas de Chapultepec, Mexico City 10, D.F., Mexico. 1948.
Sanders, Earl, 1618 N. Freeman St., Santa Ana, Calif. 1946.
Sarles, John G., 3403 Pine Crescent, Vancouver 9, B.C., Canada. 1958.
Sather, Carlyle W., 7880 Mission St., Colma 25, Calif. 1952.
Satter, John M., 4178 Millersville Rd., Indianapolis 5, Ind. 1954.

Saunders, Aretas A., Box 141, Canaan, Conn. 1909.
Sawyer, E. W., 425 N. June St., Los Angeles 4, Calif. 1952.
Schadle, Daniel P., 1029 E. Tuckey Lane, Phoenix, Ariz. 1954.
Schaefer, Hugh F., 825 Merchants Rd., Rochester 9, N.Y. 1946.
Schaughency, Charles B., Village Rd., Green Village, N. J. 1958.
Schmidt, Harold A., 317 E. El Segundo Blvd., Los Angeles 61, Calif. 1952.
Schmidt, Thomas B., 3700 Sharon St., Harrisburg, Pa. 1948.
Schneider, Fred A., % Warren Dried Fruit Co., San Jose, Calif. 1893 (1949) [Honorary].
Schoenborn, Harry, Rt. 1, Box 164, Molalla, Ore. 1950.
Scholes, R. T., U.S.O.M. to Paraguay, % Dept. of State Mail Room, Washington 25, D.C. 1948.
Schorger, A. W., 168 N. Prospect Ave., Madison 5, Wis. 1928.
Schulz, Kenneth R., 205 S. Almaden, Apt 6, San Jose, Calif. 1949.
Schumacher, Mrs. Hall L., 7027 Sycamore Ave., Seattle 7, Wash. 1953.
Schumm, William G., 302 C St., La Porte, Ind. 1945.
Schur, Ernst, Staatl. Museum fur Naturkunde, Stuttgart-O, Schloss Rosenstein, West Deutschland (Germany). 1957.
Schuster, Robert O., 1925 North St., Davis, Calif. 1945.
Schwartz, Paul A., Jr., % York Venezuela, Apartado 1766, Caracas, Venezuela. 1952.
Sciple, George W., 1511 Lander St., Seattle 44, Wash. 1957.
Scott, David M., Zoology Dept., Univ. Western Ontario, London, Ontario, Canada. 1957.
Scott, Dorothy D., 1508 La Loma Ave., Berkeley 8, Calif. 1936 (1957) [L.].
Scott, Frederic R., 115 Kennondale Lane, Richmond 26, Va., 1947.
Scott, Tom K., 345 Vine St., Menlo Park, Calif. 1952.
Scott, Walter, Box 256, Placentia, Calif. 1947.
Seamans, James O., Alcott Rd., Concord, Mass. 1957.
Seeber, Edward L., 213 Columbia St., Ithaca, N.Y. 1946.
Seibert, Henri C., Zoology Dept., Ohio Univ., Athens, Ohio. 1947.
Seibert, Milton L., Jr., Rt. 1, Box 220-A, Sunol, Calif. 1937.
Seibert, Robert F., 17 Canoe Brook Rd., Short-Hills, N.J. 1955.
Seiter, Floyd B., 59124 Main St., Box 113, New Haven, Mich. 1957.
Selander, Robert K., Zoology Dept., Univ. Texas, Austin 12, Texas. 1948.
Selle, Raymond M., 1562 Munson Ave., Los Angeles 42, Calif. 1948.
Sesnon, William T., Jr., Rm. 416, 612 S. Flower St., Los Angeles 17, Calif. 1957.
Severaid, J. Harold, Life Sciences Dept., Sacramento State College, Sacramento 19, Calif. 1946.
Shackleton, Walter H., Rt. 1, Box 76-A, Prospect, Ky. 1953.
Shaftesbury, A. D., Biology Dept., Women's College, Univ. North Carolina, Greensboro, N.C. 1945.
Sharp, William, Mirror, Alberta, Canada. 1957.
Shaub, Benjamin M., 159 Elm St., Northampton, Mass. 1948.
Shaughnessy, Winslow M., 657 Forest Ave., Glen Ellyn, Ill. 1954.
Shaw, Catherine D., 519½ N. Gramercy Pl., Los Angeles 4, Calif. 1951.
Shaw, Charles R., 554 Ursuline Dr., Baton Rouge 2, La. 1949.
Sheffler, W. J., 4731 Angeles Vista Blvd., Los Angeles 43, Calif. 1930 (1937) [L.].
Shellenberger, Emmett L., Akron Museum of Natural History, 500 Edgewood Ave., Akron 7, Ohio. 1955.
Shelton, Leonard A., 630 W. 11th St., Claremont, Calif. 1945.
Shepard, Frank P., Jr., Meadow Lane, Greenwich, Conn. 1951.
Shepherd, Peter E. K., 280 S. Fairway, Pullman, Wash. 1958.
Sherman, George L., Upper Lake, Calif. 1946.
Shires, S/Sgt. James E., 3902nd Support Sqdn. Photo Lab., Offutt AFB, Nebr. 1956.
Short, Lester L., Jr., Conservation Dept., Cornell Univ., Ithaca, N.Y. 1954.
Shoup, Herald H., Middleburg, Ind. 1957.
Sibley, Charles G., Fernow Hall, Cornell Univ., Ithaca, N.Y. 1938 (1953) [L.].
Sibley, Fred C., R.D. 1, Alpine, N.Y. 1956.
Siemens, Mrs. Dan, 5179½ Village Green, Los Angeles 16, Calif. 1955.
Silsbee, Joan, Zoology Dept., Univ. California, Berkeley 4, Calif. 1954.
Silvernale, Lee, 755 N. Robinson Rd., Topango, Calif. 1957.
Simmons, Amelia, 2676 N. Lake Dr., Milwaukee 11, Wis. 1945.
Simmons, Edward M., % E. A. McIlhenny, Avery Island, La. 1943. (1943) [L.].
Simpson, James M., 720 E. McDowell, Apt. 7, Phoenix, Ariz. 1957.
Singer, Arthur B., 30 Hightop Lane, Jericho, L.I., N.Y. 1958.
Singleton, Albert R., 3968 Marburg Ave., Cincinnati 9, Ohio. 1949.

Singleton, H. H., 1236 S. 2nd St., San Jose, Calif. 1957.
Skelton, Kathleen G., Liston Front Range Lighthouse, R.F.D. 1, Middleton, Del. 1952 (1952) [L.].
Skillen, Donald R., 419 Garfield Ave., South Pasadena, Calif. 1927.
Skinner, Milton P., 87 Lime Ave., Long Beach 2, Calif. 1915 (1920) [L.].
Skutch, Alexander F., El Quizarrá, San Isidro del General, Costa Rica. 1944.
Sloan, Norman F., 135 S. Manning, Hillsdale, Mich. 1957.
Small, Arnold, 3028 Cavendish Dr., Los Angeles 64, Calif. 1954.
Smith, Anna Margaret, 207 Alexander Ave., Larkspur, Calif. 1934.
Smith, Carolyn M., 251 S. Norton Ave., Los Angeles 4, Calif. 1953 (1953) [L.].
Smith, Clarence F., 1152 Laurel St., Berkeley 8, Calif. 1928.
Smith, Clyde G., 6005 Turner Grove Dr., Lakewood, Calif. 1957.
Smith, Craig, 301 Wyckoff Ave., Ithaca, N.Y. 1958.
Smith, C. R., 510 Park Ave., New York, N.Y. 1957.
Smith, Emily D., 19651 Glen Una Dr., Saratoga, Calif. 1921 (1955) [L.].
Smith, Harry R., 133 Monterey, Santa Cruz, Calif. 1954.
Smith, Hubert L., 232 S. Park View St., Los Angeles 57, Calif. 1956.
Smith, Loris P., 2560 61st Ave., Oakland 5, Calif. 1930.
Smith, Neal G., 1751 E. 29th St., Brooklyn 27, N.Y. 1958.
Smith, Patricia F., 2215 Rose St., Berkeley 9, Calif. 1956.
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Smith, Sally, Poughkeepsie High School, Poughkeepsie, N.Y. 1957.
Smith, S. Craig, 2 S. Clinton St., Poughkeepsie, N.Y. 1957.
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Smith, X. Martin, 816 S. Windsor Blvd., Los Angeles 5, Calif. 1948.
Smithe, Frank B., 645 W. 44th St., New York 36, N.Y. 1956.
Snell, Charles H., 4915 48th Ave., Red Deer, Alberta, Canada. 1925.
Snider, Patricia R., 3620 Gold St., Apt. 3, Los Alamos, N. M. 1954.
Snow, Angeline W., 21441 Roaring Water Way, Los Gatos, Calif. 1950.
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Southern, William, 614 Prairie St., Clare, Mich. 1956.
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Speirs, Doris H., Cobble Hill, R.R. 2, Pickering, Ontario, Canada. 1945.
Spencer, Don, 88 Secor Rd., Scarsdale, N.Y. 1953.
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Spofford, Walter R., State Univ. N.Y. Medical College, 766 Irving Ave., Syracuse 10, N.Y. 1954.
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Stein, Robert C., Biology Dept., Ursinus College, Collegeville, Pa. 1951.
Stephens, Lowell D., Jr., 911 Sheridan St., Laramie, Wyo. 1958.
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Taylor, Lewis W., Div. Poultry Husbandry, Univ. California, Berkeley 4, Calif. 1931.
Taylor, Robert L., 661 Inverness Dr., Flintridge, Pasadena 3, Calif. 1944 (1957) [L.].
Taylor, Walter P., 425 W. Harrison Ave., Claremont, Calif. 1905.
Teachenor, Dix, 1020 W. 61st St., Kansas City 13, Mo. 1922.
Teale, Edwin W., 2690 Park Ave., Baldwin, L. I., N. Y. 1947.
Terbough, John W., 4582 26th St. North, Arlington 7, Va. 1957.
Terres, John K., 345 E. 57th St., New York 22, N. Y. 1947.
Test, Frederick H., Zoology Dept., Univ. Michigan, Ann Arbor, Mich. 1936.
Tevis, Lloyd P., Jr., Box 308, Rancho Mirage, Calif. 1940.
Thaeler, Charles S., Jr., 2712 Telegraph Ave., Berkeley 5, Calif. 1957.
Thatcher, Vernon E., 210 Beatty St., Medford, Ore. 1945.
Thomas, Evelyn H., Apt. 1, 407 E. Pasadena St., Pomona, Calif. 1940.
Thomas, Harriet P., 32 Stoddard Way, Berkeley 8, Calif. 1955.
Thomas, Ray, 600 Sarbonne Rd., Los Angeles 24, Calif. 1953.
Thompson, Evan G., 586 Gulf Bldg. Addition, Houston 2, Texas. 1956.

Thompson, Floyd A., U. S. Game Management Agent, 232F S.W. South Temple, Salt Lake City, Utah. 1958.
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Thornburg, Mrs. R. J., Box 6086, Tucson, Ariz. 1952.
Thorne, Oakleigh, II, 1707 Hillside Rd., Boulder, Colo. 1947.
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Turner, James H., Box 691, Holloman AFB, N.M. 1957.
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Valentine, Allen E., 2335 Walter Rd., Westlake, Ohio. 1957.
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Vane, Robert F., 600 Dows Bldg., Cedar Rapids, Iowa. 1948.
Van Fleet, Clark C., Box 696, Lakeport, Calif. 1941.
Van Scyoc, Evelyn E., 133 North C St., Apt. 4, Exeter, Calif. 1950.
Van Tets, Gerard F., Zoology Dept., Univ. British Columbia, Vancouver, B. C., Canada. 1957.
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Verges, Eugene M., II, 1126 Beacon St., Brookline 46, Mass. 1931.
Voge, Marietta, Infectious Diseases Dept., Univ. California Medical School, Los Angeles 24, Calif. 1949.
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Wade, Otis H., 1806 Redesdale, Los Angeles 26, Calif. 1949.
Wagner, Fred H., 4454 Hillcrest Dr., Madison 5, Wis. 1954.
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Walker, Alex, Rt. 3, Box 190, Tillamook, Ore. 1911.
Walker, Charles F., Museum of Zoology, Univ. Michigan, Ann Arbor, Mich. 1942.
Walker, Ernest P., Apt. 404, 3016 Tilden St. N.W., Washington 8, D. C. 1910.
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Walkinshaw, Lawrence H., 1703 Wolverine Tower, Battle Creek, Mich. 1934 (1949) [L.].
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Washington, Dorothy C., North Edgecomb, Maine. 1948.
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Weigel, Robert D., Biology Dept., Univ. Florida, Gainesville, Fla. 1958.
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Werner, James R., Box 145, Goodyear, Ariz. 1953.
Werning, Joseph R., 1700 Third Ave., Walnut Creek, Calif. 1955.
West, David A., Fernow Hall, Cornell Univ., Ithaca, N. Y. 1957.
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White, Lt. J.G., Danforth E., 449 Waddington Way, Sunnyvale, Calif. 1952.
Whitelaw, D. M., 5760 Marguerite St., Vancouver, B. C., Canada. 1957.
Whitney, Nathaniel R., Jr., Pine Hill Dr., Rapid City, S. D. 1945.
Wick, William Q., Rt. 3, Box 323, Mount Vernon, Wash. 1955.
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Wilhoft, Daniel C., 2320 Haste St., Berkeley, Calif. 1957.
Williams, A. D., 73 Hazelwood Ave., San Francisco 12, Calif. 1951.

Williams, Alice L., 542 Anderson Rd., Davis, Calif. 1954.
Williams, David R., 9235 Whiteoak Ave., Northridge, Calif. 1956.
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Willits, Ethel S., 502 N. Pleasant, Lodi, Calif. 1946.
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Wing, Leonard W., 3875 Vorhies Rd., Ann Arbor, Mich. 1935.
Winson, J. W., Box 584, Sumas, Wash. 1925.
Winter, Frank C., 904 N. Rexford Dr., Beverly Hills, Calif. 1950.
Wise, Robert W., Rt. 1, Box 350, Woodland, Calif. 1953.
Wiseman, Philip K., Jr., Suite 3, 8555 Holloway Dr., Los Angeles 46, Calif. 1947.
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Woodbury, Angus M., 248 University St., Salt Lake City 2, Utah. 1931.
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Woody, Jack B., 4 Humboldt Village, Arcata, Calif. 1958.
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